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ABSTRACT

This manual, written especially for the Navajo and Hopi Indian Relocation Commission, is a simply worded, step-by-step guide to home maintenance for new homeowners. It can be used for self-study or it can serve as instructional material for a training class on home ownership. The manual is organized in nine sections that cover the following topics: basic information (owner's manuals, warranties, services, tools, and fire safety), electrical repairs, gas repairs, woodstove repairs, appliance repairs, plumbing, exterior maintenance, interior maintenance, and doors and windows. In each section, various simple repairs are shown in a step-by-step sequence, illustrated by line drawings. Distinction is made between the types of simple repairs that can usually be done by homeowners and those that require a professional service person. A glossary of terms completes the manual. (KC)

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Home Maintenance Manual

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Navajo and Hopi Indian Relocation Commission
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Developed by

Arizona Center for Vocational Education
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Home Maintenance Manual

Developed for

Navajo and Hopi Indian Relocation Commission

by

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INTRODUCTION

Congratulations on your new home! This book and the training are meant to help you and your family enjoy the home and keep it in good condition. This requires constant care and maintenance.

Homeowner maintenance is the inspection and repairs needed to keep a dwelling and surrounding area in good condition. Over the years of a new or newly purchased home, the owner must maintain and inspect different parts of the home for comfort, safety, warranties and to prolong the life of the home.

Some of the areas a homeowner will need to inspect and repair may include: Roof, rain gutters, exterior and interior walls, doors and windows, floors, plumbing and water systems, electrical systems, heating and cool systems, appliances and the landscaping. These areas are covered in this manual. The table of contents will list the areas you wish to find.

Some items in a new home are covered under a warranty for a period of time after the home is built. This means that the builder or contractor, has to repair or replace items, if there is any damage that is not the fault of the homeowner. Repairs under this type of warranty might include:

Outside and inside paint

Repair to wood areas, such as the siding, trim, window sills or door jambs

Loose shingles or leaky roof

Loose or damaged gutters or downspouts

Drywall or plaster with holes, loose joints or nails pulling out

Any other item that was left damaged or not completed by the contractor.

If items, such as those listed above, are caused by the homeowner, or their family, the repair is the responsibility of the homeowner. In addition, there will be many other items in the new home that will require work to keep in good condition. A look at the Table of Contents will give a good idea of repairs the home is likely to need over the years.

In addition to the information found in this book, there are some things that can be done to make the new home stay nice longer. Listed below are suggestions for doing this.

Keep all the appliances clean.

Use appliances only as directed, in the owner's manual.

Do not use too much salt or chemicals to melt ice on concrete. This can cause the sidewalk to flake and crumble off.

Repaire cracks in concrete or masonry as they are noticed. This will keep them from getting worse.

Tile or vinyl floor coverings should be kept clean by sweeping and mopping often. This will help keep them from getting scratched.

Vacuum the carpet often. This will keep the dirt from staining the carpet and from wearing it out.

Use this book and the training you receive, to help maintain a home you and your family will enjoy for many years.

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BASIC INFORMATION ....Owner's Manuals:

Do not lose them!!!

New appliances come with a set of instructions called the owner's manual. It tells how to use the appliance and much more. SAVE THE MANUAL for future use.

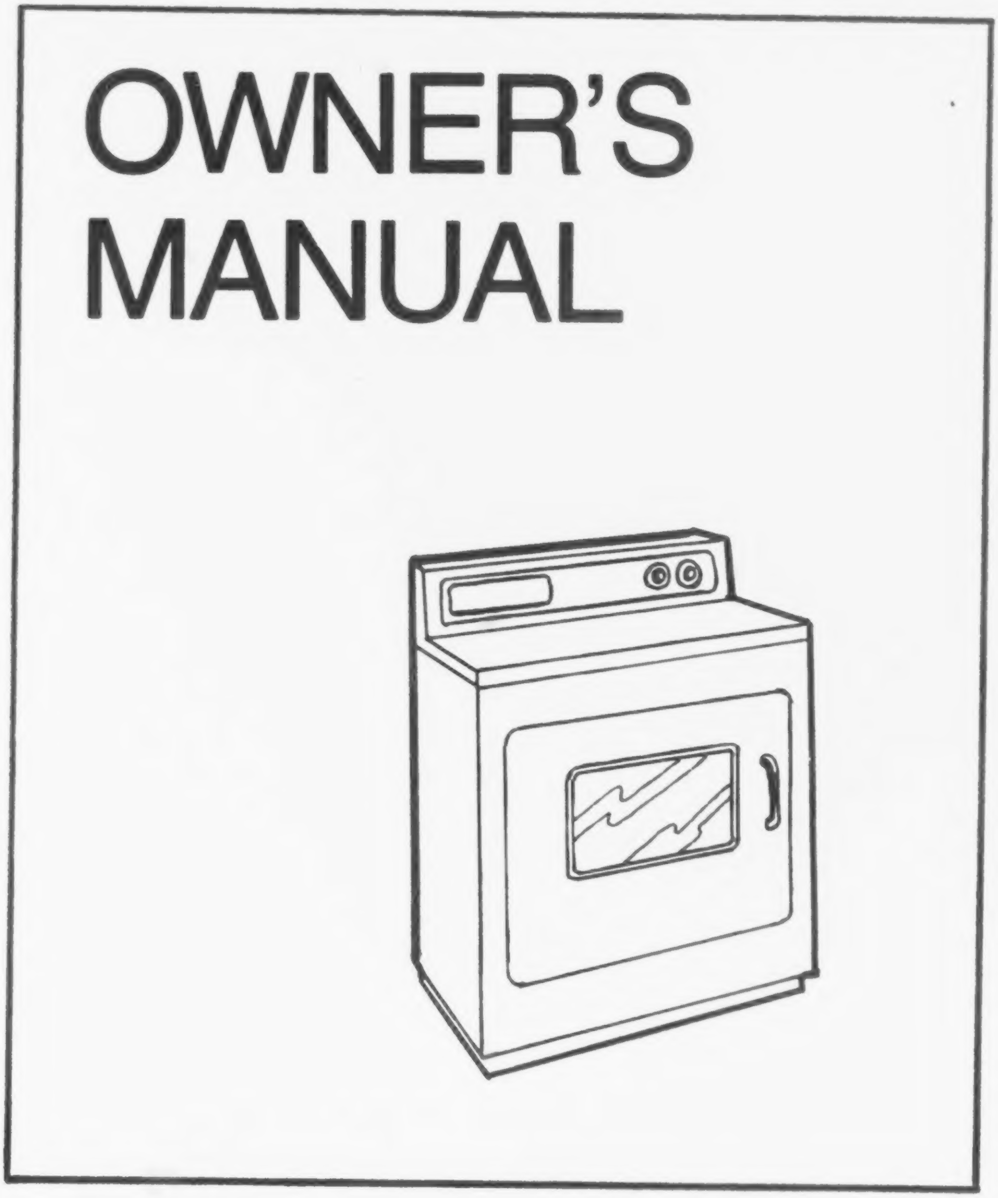


Figure 1.01. Owner's manuals are important.

What is in an owner's manual?

1. Important safety rules
2. General information about the appliance
3. Installation instructions
4. How to work the appliance
5. Cleaning and maintenance instructions
6. Some servicing and repair instructions
7. When and where to go for service
8. Technical information; wiring diagrams, parts diagrams
9. Name and address of manufacturer
10. Warranty information

CAUTION: Save the sales ticket and warranty papers.

New products and appliances have either written or implied warranties.

1. Written warranties tell how the item is guaranteed.
2. An implied warranty means that a product should do what it is supposed to do for a reasonable length of time. Usually the store where the product was bought will replace a faulty item. If the store will not replace the item, contact the manufacturer to replace it.

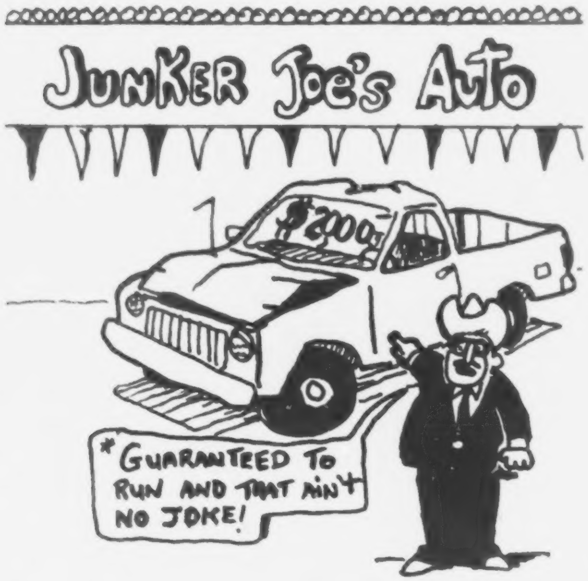

JUNKER JOE'S AUTO
$2000
*GUARANTEED TO RUN AND THAT AIN'T NO JOKE!

Figure 1.02. An example of implied warranties.

3. If a product or appliance still under warranty fails to work or breaks, what should be done? DO NOT TRY TO FIX IT!
   - A. Check the owner's manual to see if the warranty is explained in the booklet. If not, check all the other papers that came with the product.
   - B. If a written warranty exists, follow any instructions on using it.

C. It will be necessary to have the sales ticket or something that will prove where and when the product was bought. With a new home the contractor should provide this type of information along with the owner's manual and warranty.

D. Contact the store or supplier and request repair or replacement. First try by phone or in person, then follow with a letter.

E. If the store will not repair or exchange the item, contact the manufacturer. The owner's manual or warranty papers will have the address.

F. Call the Better Business Bureau, or if the item is costly, consider a visit to a lawyer.

Throughout this manual it is suggested to call or seek help from a "professional service person". Where and how to locate help depends on several things:

1. Where the item was purchased.
2. When it was purchased. Is the warranty still good?
3. Where will the service be done? A house call not covered by the warranty could be expensive.
4. The seriousness of the problem. An electrical or gas repair can be dangerous. This type of problem is best handled by a "professional service person".

This manual suggests basic maintenance and repair projects for the home and its appliances. However, even the best "do-it-yourselfer" comes to a point at which professional help is needed.

If it is necessary to seek help for repairs, there are several questions to be asked.

1. What is the nearest service company? Be prepared to give directions to the house, from someplace that can be located on a map.
2. Is it under warranty? Check the purchase date against the "paperwork".
3. Can the service company do the repair? Do they have the required parts?
4. Ask for an estimate of cost in advance. If this service is not under warranty, it is best to shop around.

For easy reference when repairs are needed, complete the following:

RANGE/STOVE

Model: ______________________________ Serial Number: ______________________

Warranty Expires: ____________________ Contact: ___________________________

REFRIGERATOR/FREEZER

Model: ______________________________ Serial Number: ______________________

Warranty Expires: ____________________ Contact: ___________________________

HOT WATER HEATER

Model: ______________________________ Serial Number: ______________________

Warranty Expires: ____________________ Contact: ___________________________

WASHING MACHINE

Model: ______________________________ Serial Number: ______________________

Warranty Expires: ____________________ Contact: ___________________________

CLOTHES DRYER

Model: ______________________________ Serial Number: ______________________

Warranty Expires: ____________________ Contact: ___________________________

Tools to maintain the house can cost a lot if everything is bought at once. It can cost even more if the best quality tools are bought. Consider shopping around and buying from discount stores.

The following tools would make a good home tool kit.

BASIC TOOLS	COMMON USE
2 sizes regular tip screwdrivers	Driving and pulling screws
2 sizes phillips tip screwdrivers	Driving and pulling screws
Linesman's pliers	Cutting wire, holding things
6" to 8" needle nose pliers	Holding small things, twisting wire
8" to 10" Visegrips (tm)	Clamping, gripping
6" AND 12" adjustable wrenches (Channel Locks)	Holding, turning nuts, bolts, etc.
Utility knife (razor edge type)	Cutting
1/2" wood chisel and cold chisel	Cutting and carving
8 point crosscut saw	Cutting boards
16 oz. curve claw hammer	Driving and removing nails
12' to 16' steel tape measure	Measuring
Putty knives, trowel	Spreading materials
Plumbing plunger	Unclogging drains
Flashlight	Seeing in the dark

ADDITIONAL TOOLS	COMMON USE
10" AND 14" pipe wrenches	Holding and turning pipes
Wire brush	Removing paint, cleaning
Combination square	Marking and measuring
Hacksaw	Cutting metal
Tubing cutter	Cutting copper tubing

ADDITIONAL TOOLS	COMMON USE
Glass cutter	Repairing windows
Caulking gun	Weatherizing, filling leaks
Triangular file	Filing metal, sharpening
Neon test light	Testing for "live electricity"
Continuity testor	Checking electrical circuits
Chimney brush	Cleaning flue pipes
Drill (power or hand)	Drilling holes and other uses
Drill bit set	Drilling right size holes
Paint brushes, rollers, pans	Painting
Bucket	Mixing
Pry bar	Prying
Allen wrenches	For use with allen screws
Gloves	Hand protection
Spray bottle	Wetting and cleaning
Propane torch	Soldering, heating
Tool box and lock for box	Storing and securing
Basin wrench	Removing hard to reach locknuts
Drain auger	Unclogging drains

CAUTION: FIRE is dangerous. Read the instructions for use of the fire extinguishers often.

All homes should have at least one fire extinguisher that is fully charged. The following will tell how to select, care for, and use fire extinguishers.

1. SELECTION: There are several types and sizes of fire extinguishers available. Homeowners will find that two medium-sized "A-B-C" units will do. "A-B-C" means the extinguisher can be used to put out electric, grease, wood or paper fires. "One-use-only" or refillable fire extinguishers are available. A refillable extinguisher is cheaper over the years.

2. PLACEMENT: One extinguisher should be in the kitchen, close to the cooking area. If the woodstove is not close to the kitchen, a second extinguisher should be placed near it.

3. MAINTENANCE: The following should be done at least once every month.

   A. Check the pressure gauge to be sure the extinguisher is charged.

   B. See that the safety pin is securely in place.

   C. Check nozzle for anything clogging it.

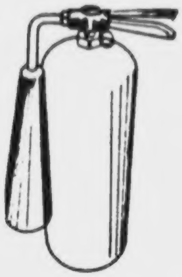


Figure 1.03. Fire extinguisher.

   D. Do not TEST by using or it will need to be recharged or replaced.

4. USE: Read the instructions that come with the extinguisher. Without using the fire extinguisher, show everyone in the family how to make it work.

CAUTION: Check and test the battery often!

It is best to have both battery powered and house current powered models. Most battery powered smoke detectors make a "chirping" sound when the battery gets weak. If that happens, replace the battery right away. Press the test button every now and then to see if the battery is still strong enough to sound an alarm.

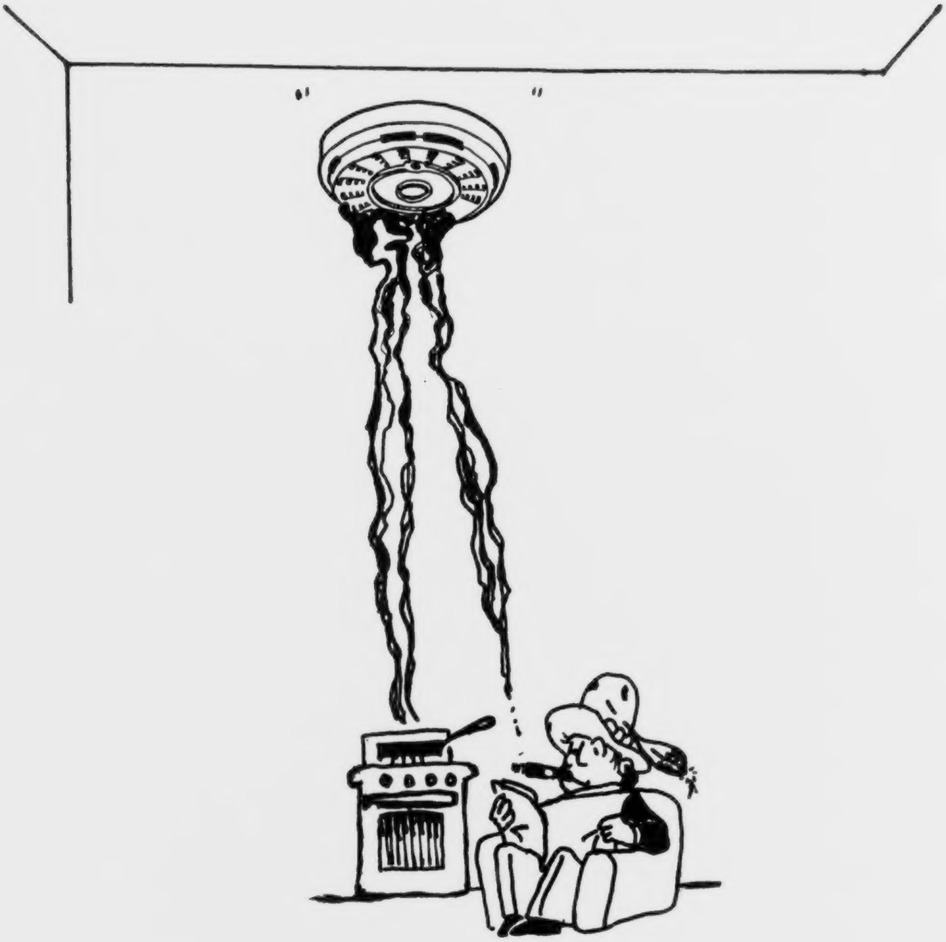


Figure 1.04. Smoke detector.

ELECTRICAL . . . . Safety:

Electricity can be very dangerous. It can cause serious burns, or even cause death. Before inspecting or attempting to repair any appliance or any part of the home's wiring system, observe these cautions:

1. Do not guess about electricity. Use a VOLTAGE TESTER to check for live wires. See the section on "Basic Electrical Service".
2. Never inspect or repair any electrical system until the power is turned off. To do this, first TEST THE TESTER on a live outlet to be sure it is working. Check all the wires to be worked on, to be certain the power to them is off.
3. Do not touch heating ducts, plumbing pipes or gas system pipes while doing anything to an electrical system. If something is "live" (with power), touching metal will complete a circuit and could give a dangerous shock.
4. Do not stand on a wet or damp surface when working on an electrical system. Wear rubber bottom shoes such as "tennis shoes" and stand on dry surfaces. A rubber door mat is a safe surface to stand on when working with electricity.
5. Some appliances store electricity, even after the power is off. These appliances can still give a shock. To keep from getting a shock, touch the prongs of a plug to a metal faucet or other ground.
6. Use only parts, supplies and appliances listed by Underwriters Laboratories, shown as "U.L. Listed". This is printed on the product.
7. If any device gives a shock, no matter how small, unplug it until the cause has been found. Call a service person for help, if the problem cannot be found.

CAUTION: **Read the section on ELECTRICAL: SAFETY, before doing any electrical service. Be sure the power is off before making any electrical repair.**

PROBLEM: An electrical fixture needs repair.

INFORMATION: Find the service panel. Look in the utility room or outside the house. Turn off the main power to the house before beginning repairs. This is done by turning a large handle or switch, on the service panel, to the off position.

TOOLS AND MATERIALS:

Circuit Tester

Continuity Tester

THE JOB: Using A Circuit Tester

A circuit tester uses a light bulb that glows whenever the circuit or device tested has electricity (voltage) present. There are two wire leads that can be used to test items.

Testing An Outlet: Using A Circuit Tester

Step 1. Insert both of the wire leads of the circuit tester in the narrow slots of a outlet. If there is electrical current present, the bulb of the tester will glow. If the bulb does not glow, check the tester in an outlet that is known to be working. This is to make sure the tester is working.

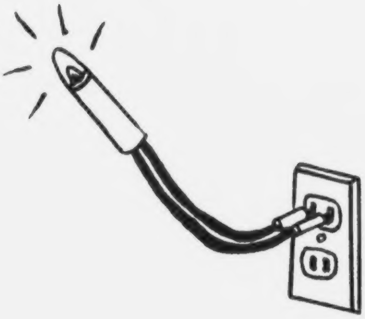


Figure 2.01. Circuit tester.

Step 2. The circuit tester can be used anywhere that electricity might (or might not) be present. Always check each wire or connection against other connections for the presence of electrical power.

Testing A Switch: Using A Circuit Tester

Step 1. Turn off power to the switch at the circuit breaker or fuse box.

Step 2. Remove the cover plate and pull the switch out of the wall box carefully.

Step 3. Turn the power on.

Step 4. Put the ends of the circuit tester on the wires, carefully. Do not allow the leads to touch each other or anything else. In the "on" position, the bulb should glow. If not, the switch is bad. In the "off" position, there should be no glow. If there is a glowing bulb in the "off" position, the switch is also bad.

THE JOB: Using A Continuity Tester

A continuity tester is very much like a circuit tester in that it has its own power source, usually a battery or two. It CANNOT be used on circuits that have electricity present. Be SURE the power is off.

Testing A Switch: Using A Continuity Tester

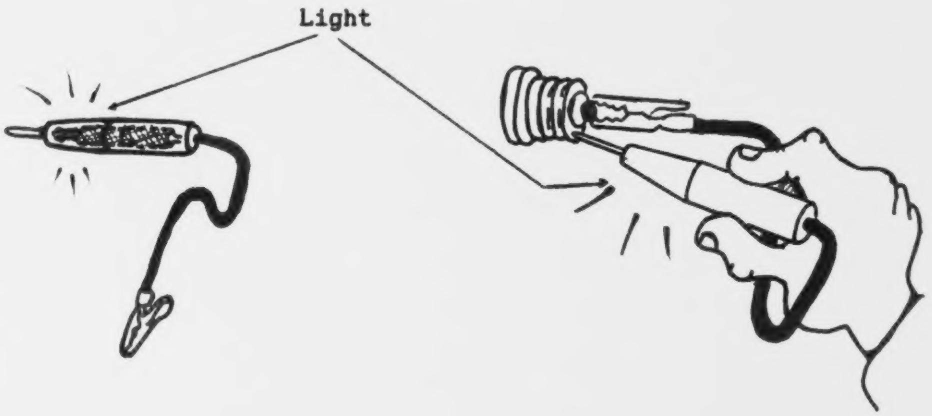


Figure 2.02. Continuity testers.

Step 1. Be sure the continuity tester is working by touching both leads together. The bulb should glow. If not, the batteries or the bulb is dead. Fix this before moving on.

Step 2. Use a circuit tester to be sure the power is off.

Step 3. When the switch is in the "on" position, applying the continuity tester leads should cause the bulb to light. In the "off" position, no light should show.

Step 4. The same steps as above can be used on any kind of switch. Be sure the power is off and then test by turning it on and off.

Testing Cords and Plugs: Using a Continuity Tester

Step 1. Unplug the cord and plug assembly by unplugging both ends, or by unplugging one end and disconnecting the other end at the appliance.

Step 2. Touch the leads of the continuity tester to both ends of the plug/cord assembly. If there are no electrical problems here, the bulb should glow. If the bulb does not glow, the plug or cord needs to be repaired.

CAUTION: Use safety procedures!

PROBLEM: Plug at the end of an appliance cord has pulled off, is loose, or the appliance cord has a bad section in it.

INFORMATION: Loose plugs or bad cords are potential fire and electrical shock hazards. They need to be fixed as soon as noticed. There are different kinds of replacement cords and plugs at hardware or electrical supply stores. What is needed depends on the type and size of the original cord and plug. It is best to take the entire appliance, or at least the cord/plug setup to the store when buying the replacement.

TOOLS AND MATERIALS:

Knife to cut and strip wire

Smaller size standard screwdriver

Electrical (vinyl) tape

Wire cutters

Replacement cord/plug

Needle nose pliers

THE JOB: **Repairing The Cord**

Step 1. The safest repair is to replace the entire cord and plug assembly. If the cord or plug is badly worn in one place it is probably worn out in other places also. Be sure to get a cord the same size.

Step 2. If a temporary cord repair is necessary, follow these steps to "splice" it:

A. Unplug the cord from the outlet.

B. Remove the insulation and covering for the problem area with a knife.

C. If the wires are not broken, first wrap each wire separately with several tight turns of electrical tape. The tape should cover insulated parts of the wire as well as the bare wire in three layers.

D. After both, or all three wires are individually wrapped, wrap the entire assembly tightly and throughly.

E. If the electrical wires are broken they must be "spliced". The splice should be as flat as possible. The wire ends should be wound tightly around each other to provide a maximum of wire-to-wire contact. Again, tape individual wires separately and then the entire splice.

THE JOB: Replacing The Plug

The replacement of a plug must be done carefully. For the family's safety, use the best quality replacement.

Replacing A Plug On A Flat Two-Wire Cord

Step 1. Use a "snap-down" plug type for flat wire replacements. Several styles are available. Most have instructions. Ask supplier how they work.

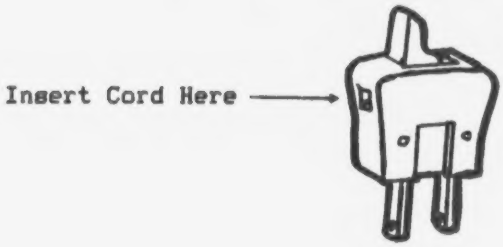


Figure 2.03. Snap Plug.

Step 2. Lift the top clamp.

Step 3. Slit the flat cords apart for 1/4" back from the end of the cord.

Step 4. Push the cord into the plug and tightly close the clamp.

Step 5. Test to see that it works. Hold the plug after use to be sure it does not heat up.

Replacing A Plug On A Cord With Two Round Wires

There will be round wires underneath the cord's outer cover.

Step 1. Pull wire through plug and tie an "underwriters" knot as shown, to prevent wire from pulling out.

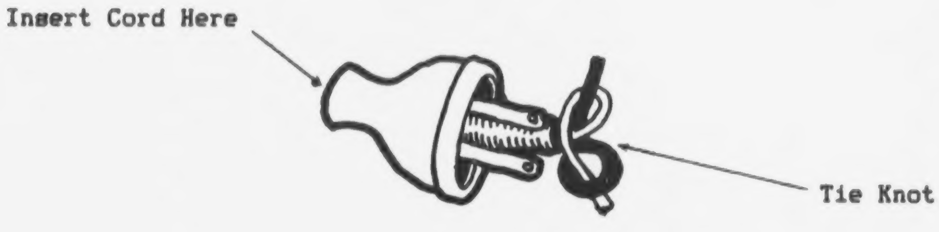


Figure 2.04. Cord with two round wires.

Step 2. Strip about 1/2" of insulation from the wires.

Step 3. Twist each wire into a tight pack of strands.

Step 4. Loop the wires behind the plug prongs and around the screws.

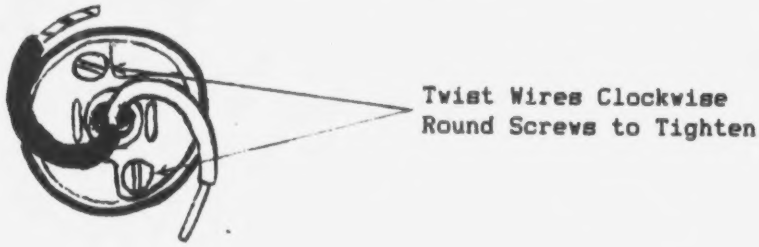

Twist Wires Clockwise
Round Screws to Tighten

Figure 2.05. Behind the plug prongs.

Step 5. Tighten the wire under the screws and trim off excess wire.

Step 6. Inspect the plug to be sure that no loose strands of the white wire are anywhere near the black wire.

Step 7. Install the cardboard or plastic wire cover over the exposed part of the plug.

Replacing A Plug On Three Round Wires

A grounded three-prong plug.

Step 1. Tie all three wires in a knot, if there is enough room. If there is NOT enough room, tie the white and black wires to prevent them from being pulled out.

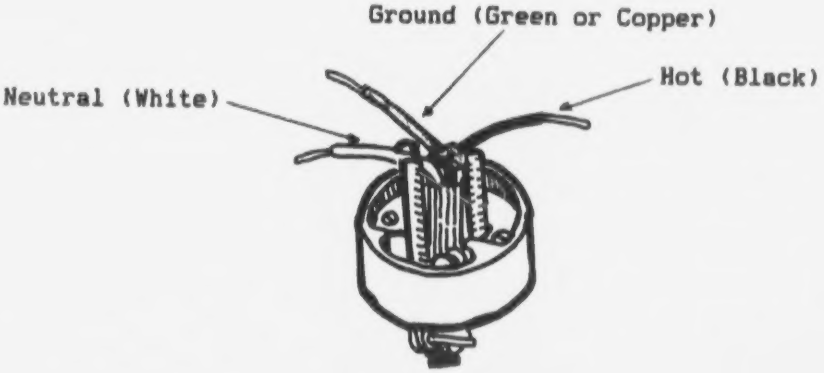

Ground (Green or Copper)
Hot (Black)
Neutral (White)

Figure 2.06. 3-Phase Plug.

Step 2. Strip about 1/2" of insulation from each wire using a knife.

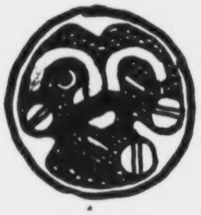
Step 3. Twist each wire into a tight pack of strands.

Step 4. Place wires under screws and tighten the screws.

Step 5. The bare wire goes to the grounded round prong.

Step 6. Cut off excess wire.

Step 7. Do not allow the wires to touch each other.



Tighten Screws and
Replace the Cover.

Figure 2.07. Inside a 3-phase plug.

Step 8. Put on the cardboard or plastic cover and tighten screws that secure the cord, if the plug has one.

Step 9. Test the plug/appliance. Make sure the plug does not heat up.

CAUTION: Use safety procedures!

PROBLEM: House had a "dead" circuit or an appliance does not work. Testing with a voltage tester or an appliance, such as a lamp, known to work on another circuit, shows no current on the circuit.

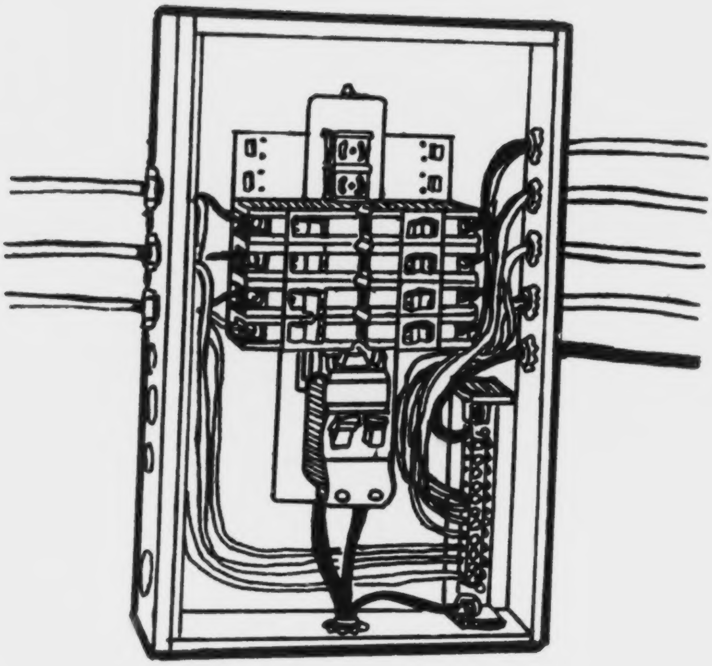


Figure 2.08. Circuit Panel.

INFORMATION: When electricity enters a house, the wires from the power company are hooked into a service panel. This box is also known as a breaker box or fuse box. These boxes will contain a main disconnect, either large fuse blocks with handles to pull or a very big pair of circuit breaker switches. The box may be inside the house, in a utility room, or outside close to where the electricity enters the house.

Both circuit breakers and fuses are of different types and sizes. If either needs replacement, be sure to use the EXACT replacement size.

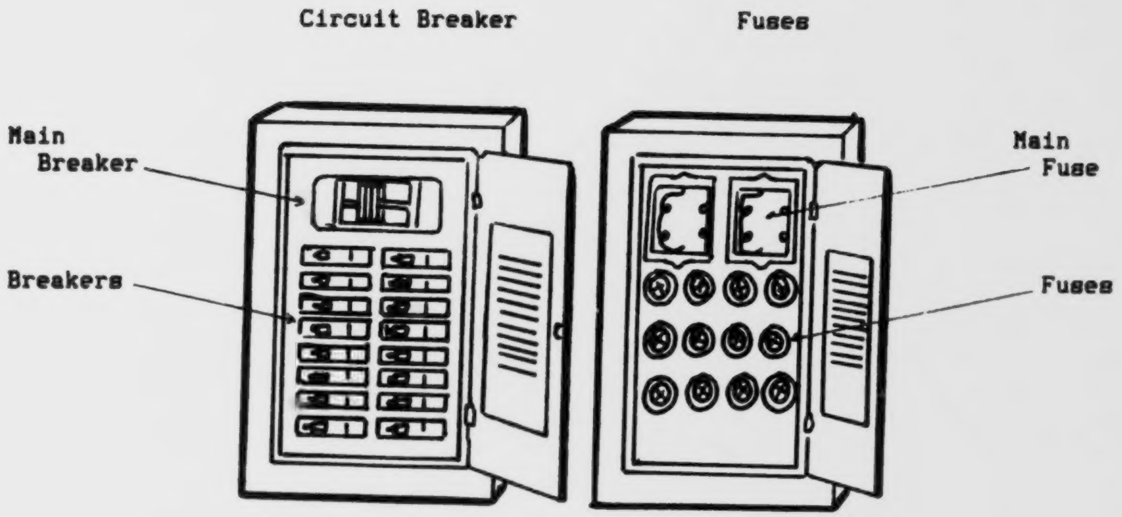

Circuit Breaker
Fuses
Main Breaker
Breakers
Main Fuse
Fuses

Figure 2.9. Service Panels.

TOOLS AND MATERIALS:

Screwdriver

New fuse or circuit breaker

THE JOB: Replacing A Cartridge-Type Fuse

Step 1. Turn off all power to the panel by pulling out the main disconnect switch. Keep it out for now.

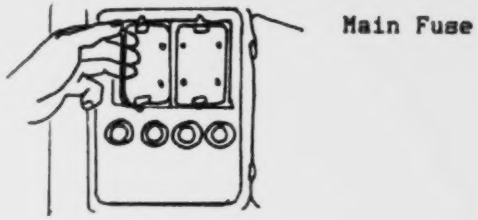


Figure 2.10. Cartridge-type fuse.

Step 2. Pull out the cartridge fuse. If fingers can not do it, use pliers. Then replace it. If there is corrosion on the contacts, sandpaper it clean.

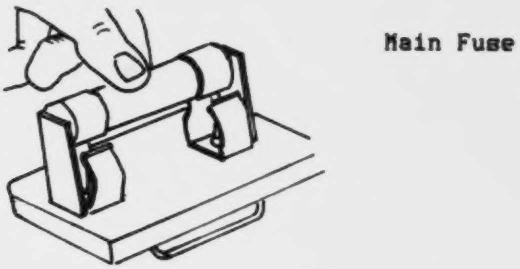


Figure 2.11. Fuse.

THE JOB: Replacing A Screw-In Fuse

Step 1. Pull the main disconnect box, or turn off the disconnect switch.

Step 2. Locate the fuse that has blown. The "window" of the fuse may be black, or the fuse link may be broken.

Step 3. Remove the fuse by turning counter clockwise.

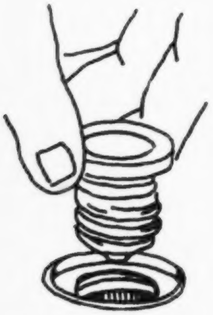


Figure 2.12. Turn counter clockwise to remove.

Step 4. Replace with either an identical type/size fuse or install screw-in circuit breakers. These can be used over again.

THE JOB: Replacing A Faulty Circuit Breaker.

Circuit breakers usually last a long time. Push the switch past the "off position and then back to "on". Retest the circuit. If it is still without power, follow these steps.

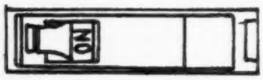


Figure 2.13. Circuit Breaker.

Step 1. Turn off power to all circuit breakers. This is done by switching off the bigger main circuit breaker, or a house main disconnect switch.

Step 2. Pry and/or wiggle out the circuit breaker. Replace it with one that is the same size.

For each of these replacements, turn the main power back on, and then wait. Usually what caused the fuse to blow or circuit breaker to go "off" was an overload to that circuit. Too many electrical uses at once will cause this. If this happens again there may be a dangerous situation. Try to disconnect the appliances one at a time to locate the overload. If this does not solve the problem, get some professional help.

NOTE: Keep extra fuses or circuit breakers near the box, where they can be found in the dark. Also, know where the flashlight is. This will make the repair quicker to do after dark.

CAUTION: Use safety procedures!

PROBLEM: A light fixture or other appliance controlled by a wall switch fails to work.

INFORMATION: All types of electrical switches can go bad as they get older. Most wall switches, are simple on/off devices that stop the flow of power. Other switches, are two way or three way, thet allow the power to be turned on and off from two or more places in the house.

TOOLS AND MATERIALS:

Screwdriver set

Needle nose pliers

Replacement switch, like the one not working

Voltage tester

THE JOB: Replacing A Wall Switch

Step 1. Check the light bulb or appliance in another circuit.

Step 2. Remove the fuse, or switch off the circuit breaker that controls the power to this circuit.

Step 3. Remove the two screws, and remove the plastic cover plate.

Step 4. Carefully pull the switch and wires out of the box.

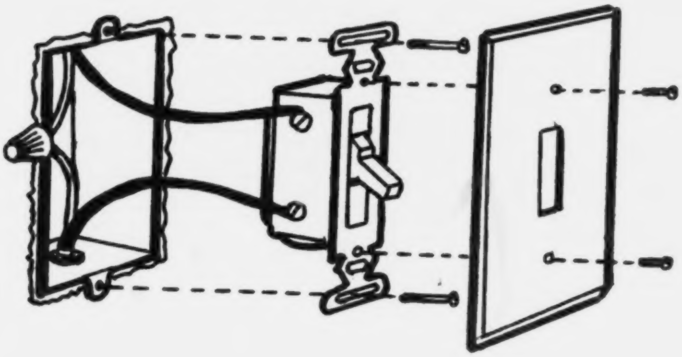


Figure 2.14. Wall Switch.

Step 5. Test the voltage tester on another circuit that is live, to make sure it is working.

Step 6. Place the voltage tester leads against each screw or wire connection on the switch. If there is any current at all, recheck to see that the power to this circuit if OFF.

Step 7. With the power off, unscrew the switch from the wires. If there are more that the usual two black wires, make a drawing of the way the switch is connected.

Step 8. Take the switch when buying a new one, to make sure it is the same style and service rating.

Step 9. Hook up the new switch, just like the old switch was hooked up.

Step 10. Extra or bare wires should not be sticking out from the switch. If they do, recheck the switch and correct the wiring.

Step 11. Carefully bend the wires to allow hook up of the switch. Tighten the screws.

Step 12. Turn the power on and test the switch.

If the light or appliance still does not work, call an electrician for professional help. If circuit breakers or fuses go off again, call for help!

CAUTION: Use safety procedures!

PROBLEM: Faulty wall outlet. Symptom might be an appliance or lamp that does not work when plugged in.

INFORMATION: Does the appliance work when plugged into a different outlet? If so, the problem is a defective outlet. Outlets, also called receptacles, do wear out. Does wiggling the plug make the appliance work? If so, replace the outlet. Be sure that this outlet isn't controlled by a wall switch, and just turned off before going further.

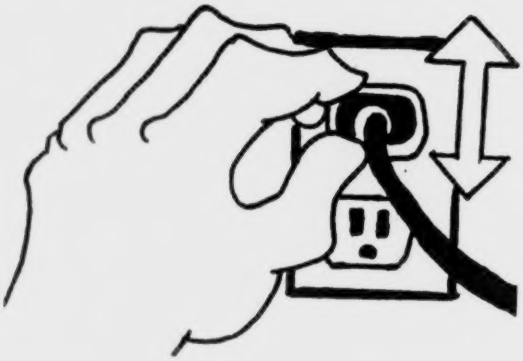


Figure 2.15. Wall receptacle (outlet).

TOOLS AND MATERIALS:

Medium, regular screwdriver

Voltage tester

Needle nose pliers

Replacement outlet

Knife

THE JOB: **Testing And Replacing Wall Outlets**

Step 1. Turn off the power to the outlet at the service panel.

CAUTION: If it is unknown which circuit breaker turns the power off, turn off all power and use a flashlight.

Step 2. Remove the screw and cover plate to get to the two screws that hold the outlet to the box in the wall.

Step 3. Remove the two screws. Carefully pull the receptacle out of the outlet box.

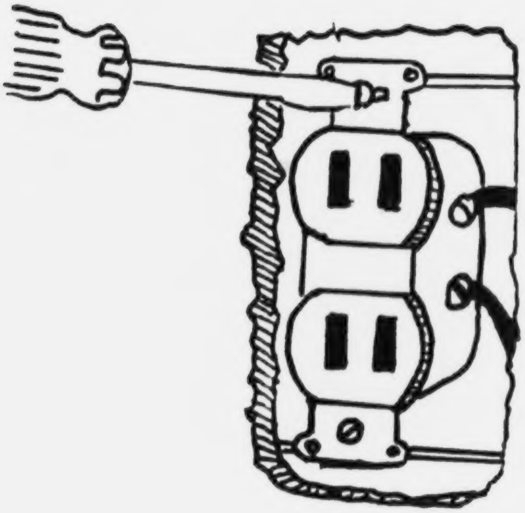


Figure 2.16. Removing wall outlet.

Step 4. Check to see if there is power to the outlet now. Carefully touch the leads of a voltage tester to the brass and silver screws. If the tester shows power is on, make sure it is off by turning "off" circuit breakers, fuses, or the main power disconnect.

Step 5. Remove the connecting wires. If the wires are not fastened to the screws, they are pushed into push-in connectors. A small screwdriver is needed to insert in the slot next to the hole where the wire goes. Push the screwdriver in while pulling on the wire.

CAUTION: Pay attention to where each wire goes. If doing the wires one at a time, they can be moved to the same screw.

Step 6. When installing a new outlet, be sure the right wires go to the right screws.

A. Bare wire or insulated green wire goes to the green terminal.

B. Black or red wire goes to the brass colored terminal.

C. White or gray wire goes to the silver colored terminal.

Step 7. After replacing the receptacle in the outlet box:

A. Replace faceplate or cover plate.

B. Turn the power on to test the circuit.

C. Test the outlet box.

PROBLEM: The house has a sun-powered, or solar electrical system that does not seem to be providing as much power as it used to.

INFORMATION: Photovoltaic (called "PV's") systems depend on several things to operate at their best.

1. There must be plenty of sunshine to strike the panels and keep the system's batteries charged.
2. The surfaces of the solar panels must be clean and unshaded.
3. All electrical connections must be clean, tight and free of corrosion.

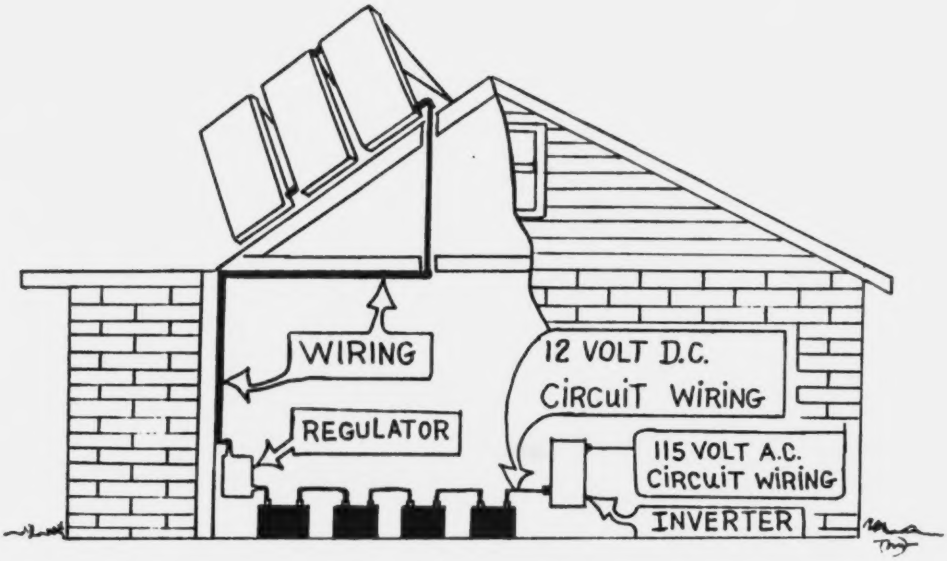


Figure 2.17. Photovoltaic system.

4. Batteries must be in good condition and filled to the proper level.
5. Electrical devices, such as regulators and invertors (units which change 12 volt DC to 115 volt AC power), must be working properly. THESE CAN ONLY BE SERVICED BY PROFESSIONALS.
6. PV systems vary in size. The larger the system, it has the more panels and batteries, and the more electrical power you have. If you are "running out" of power often, it may be because the system is too small to keep up with your needs. Consult with the manufacturer or installer of the system to see if this is the case.
7. Some homes that have PV systems are double wired. One wiring system will allow only 12 volt DC appliances. The other system is for 115 volt AC use and power is supplied by the invertor or a community system. DO NOT attach 12 volt appliances to 115 volt systems or 115 volt appliances to 12 volt systems. IT IS DANGEROUS!

TOOLS AND MATERIALS:

Cleaning rags

Glass cleaner or ammonia

Wire brush or steel wool

Distilled water

Petroleum jelly (Vaseline)

Pliers

Wrenches

Screwdriver

Ladder

THE JOB: Cleaning And Inspecting Roof Mounted Photovoltaic Systems.

Step 1. When the weather is good and winds are very light, use a safe ladder to get up on the roof.

Step 2. Inspect all parts of the solar panels and the mounting frame(s). Tighten any loose parts or plan to replace any if damaged. These panels are very expensive and the wind could tear them off and destroy them.

Step 3. Clean and dry the glass surface of the panels.

Step 4. Check that all the wiring and connections are tight and undamaged. If corrosion is evident, take apart the conections to clean and reassemble. Coat the connections with petroleum jelly before putting them back together.

THE JOB: Servicing The Batteries.

Step 1. Remove the cover that protects the batteries.

CAUTION: Like car batteries, these "deep cycle" batteries have acid that can cause severe burns. Be careful.

Step 2. Inspect the electrolyte, water plus acid, (BE CAREFUL!) level in each cell of the battery by unscrewing the caps or removing the plastic bars with 3 caps on each bar.

Step 3. If the level is low, add DISTILLED water to the top of each cell as in a car battery.

Step 4. Inspect the electrical cables or bars between the batteries for corrosion. Remove, clean and reinstall if needed.

Step 5. If the batteries are old, take them to an auto service center for testing.

GAS . . . . Safety:

CAUTION: Like all energy sources, gas can be dangerous. Whether from a community pipeline or own tank, it is a fuel which can explode if conditions are wrong in the home.

1. Refer to and read each section of this manual that relates to gas appliances such as ranges, ovens, water heaters and space heaters.

2. There are some common "dos and don'ts" that are important in using natural gas or propane as a fuel:

   DO:

   A. Keep gas appliances very clean as the flame can ignite dirt and grease build up.

   B. Show children the correct way to operate gas appliances.

   C. Make sure all pipes and connections are secure with no leaks.

   D. Call the gas supplier if there is a gas smell and the source cannot be found. Call from somewhere else.

   E. Follow all instructions and safety tips in the owner's manual, or from the gas supplier.

   DON'T:

   A. Allow flues and vents to become dirty. Clean them regularly.

   B. Try repairs and adjustments to a gas appliance. This is a job for the professionals.

   C. Light a gas appliance when you smell gas. Let the room(s) air out first, with the gas to the appliance off.

   D. Forget to keep a FULLY CHARGED fire extinguisher available.

3. Gas has a "stinky" additive that smells like rotten eggs. If there is a gas smell:

   A. Open windows and doors to air out the house.

   B. Avoid flames, sparks. Do not even operate an electrical switch.

   C. Call the nearest gas company or fire department for their advice. Call from somewhere else.

D. Turn off the main gas valve, at the tank or where it enters the house.

E. If the gas smell is really strong, leave the house and call for help from somewhere else.

F. Let a qualified service person turn the gas back on. Also, let them relight all the gas appliances and pilot lights.

4. If the appliance does not have enough air, it will not burn all the gas. This can produce carbon monoxide (C.O.) poisoning.

The symptoms of not enough air to the gas appliance can be:

A. A wavering flame

B. Soot

C. Smell (gas)

D. Yellow flame

E. Overheating

Some of the symptoms of bad air (C.O.) poisoning are:

A. Headaches

B. Yawning

C. Ears ringing

D. Tired feeling

E. Vomiting

F. Irregular heart beat

If this happens:

A. Get fresh air. Air out the house, by opening the doors and windows, and go outside.

B. Shut off the gas at the appliance or the main valve.

C. Seek expert help right away.

PROBLEM: The pilot light in a gas appliance has gone out and needs relighting.

INFORMATION: There are two types of gas pilot lighting systems. Automatic lighting gas appliances do not keep a pilot flame going. These do not have to be lit. Manual pilot lights need attention when the wind causes the pilot light flame to go out. Refer to the owner's manual to find out which type of pilot light the appliance has, and how to relight it.

THE JOB: Lighting A Pilot Light

Step 1. If the pilot light has been off for some time because there is a gas smell, air the room or house by opening windows and doors.

Step 2. Many gas appliances have a safety device known as a thermocouple. This device shuts off the supply of gas to the pilot light when it goes out. If the gas appliance has one of these, check the owner's manual. Turn the control unit to "pilot" before lighting the appliance.

Step 3. After airing out the room, or smelling no gas, relight the appliance.

Step 4. Following is information on relighting a gas water heater. Other gas appliances are relit in much the same way. Water heaters all have a thermocouple to shut of the gas to the pilot light if it goes out. Follow the owner's manual instructions.

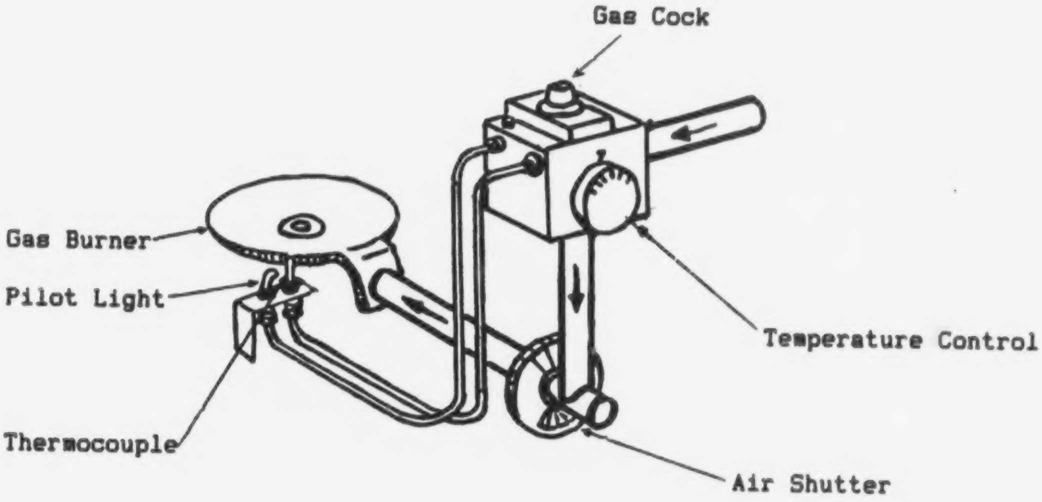


Figure 3.01. Pilot light in a gas hot water heater.

Step 5. The most common procedures for relighting the water heater's pilot light are as follows:

A. Air out the house, by opening the doors and windows, to get rid of the smell of gas.

B. Turn the gas cock (VALVE) to "pilot" or "light pilot".

C. Press the gas cock button down while holding a wooden kitchen match at the pilot light. Sometimes it is necessary to hold the match with a pair of pliers to be able to reach the pilot light AND to remove the unburned part of the match.

D. Continue holding down the control button for at least five (5) seconds, or as long as the owner's manual says.

E. Release the button and watch the pilot light to be sure it stays on. If it DOES NOT stay on after several repeats of steps A through D above, call for expert help. Gas can be dangerous.

WOODSTOVE . . . . Safety:

Woodstove safety means keeping a fire going inside the woodstove without burning anything else like the walls, floor, rug, flue, ceiling or roof.

HEAT PROTECTION: All woodstoves have minimum distances that the stove and flue pipe should be kept from anything that could burn. Do not change these distances. Only insulated, or triplewall stovepipe is used where the flue passes through the ceiling or wall to the outside.

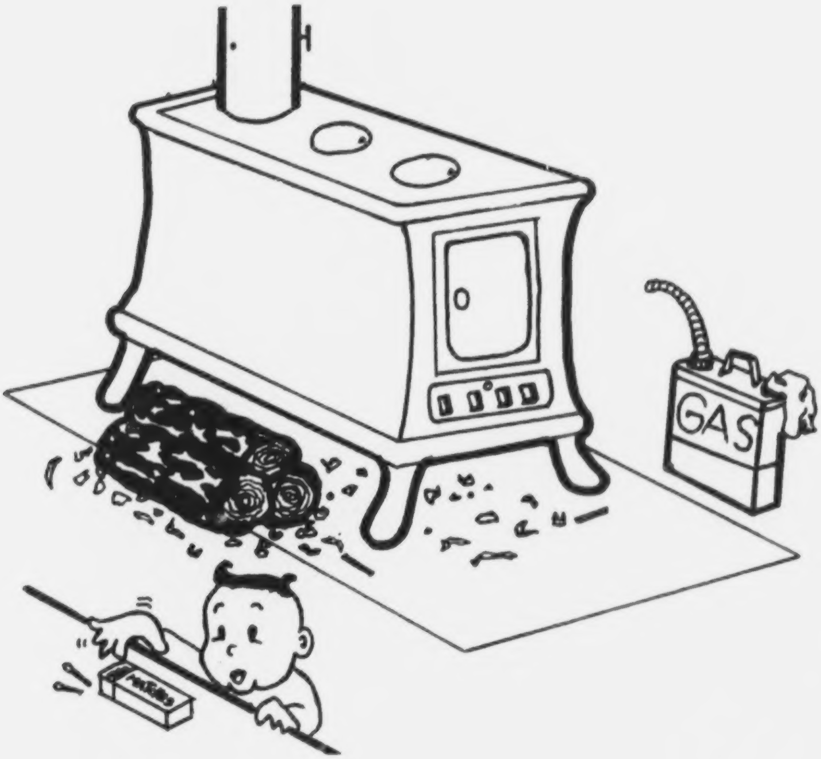


Figure 4.01. Woodstove safety. What is wrong with this picture?

DON'T:

1. Stack firewood close to the stove.
2. Bring gas cans or soaked rags into a home with a woodstove.
3. Allow woodchips and scraps to pile up near stove on the floor.
4. Keep kindling and paper close to the stove.
5. Store matches near to the stove or where children can get them.
6. Start fire with gas, kerosene, lighter fluid or other flammable liquids.

PROBLEM: Smoke is leaking into the house from some part of the woodstove. This is usually caused by build up of deposits in the stove pipe. Soot and creosote need to be scrubbed out.

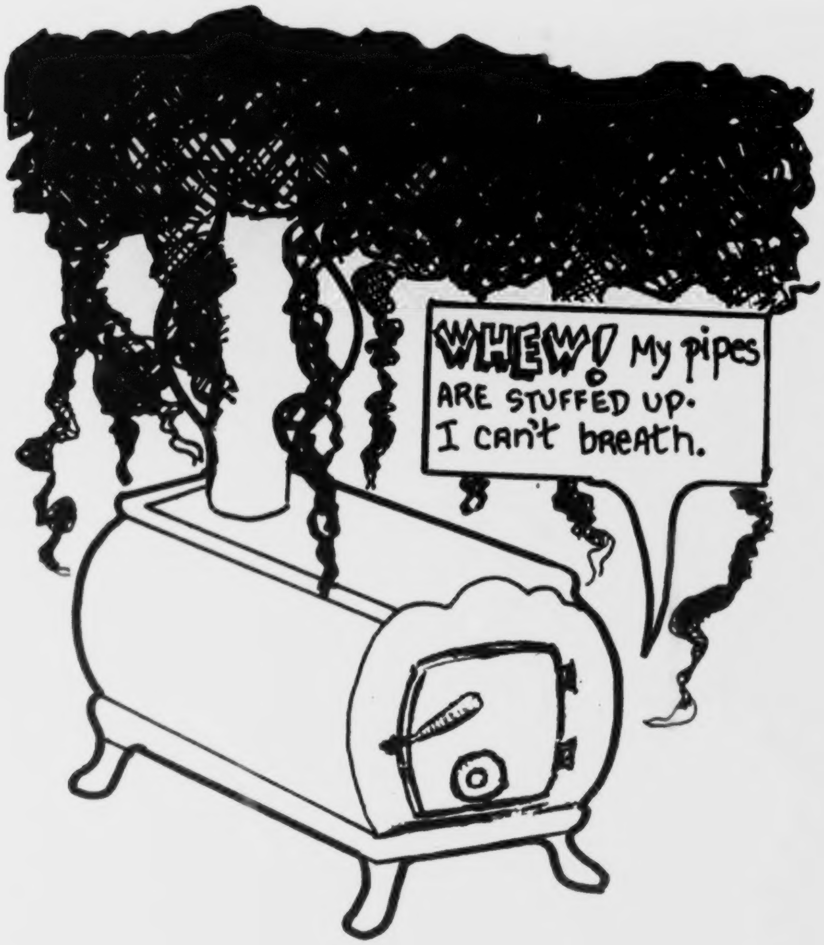

WHEW! My pipes ARE STUFFED UP. I can't breath.

Figure 4.02. Clogged Stove Pipe.

INFORMATION: Stove pipe deposits that build up not only cause smoke but CAN catch on fire. Flue fires can get hot enough to catch the house on fire and burn it down. The more "airtight" the stove, the worse the problem will be. If the stove has a catalytic converter, consult the owner's manual for cleaning instructions.

TOOLS AND MATERIALS:

Gloves

Regular and phillips screwdrivers

Newspaper

Masking tape or wire

Paper grocery sack or plastic bag

Flashlight

Ladder to get on roof

Flue brush. Buy flue brushes to fit the stove pipe. Brushes come in round or square shapes. 6" or 8" sizes are most common. Be sure to measure the inside size of the stove pipe. The following itmes may be used if a flue brush is not available.

A. Put snow-tire chains in a burlap sack, tie the sack to a rope long enough to reach the length of the stove pipe.

B. Woodback brushes can be nailed to a chunk of 4 X 4 wood with weights below and rope. Tie the wood to a rope long enough to reach the length of the stove pipe.

C. A round wire brush from a welding or bench grinder can be bolted to a length of 1/2" pipe.

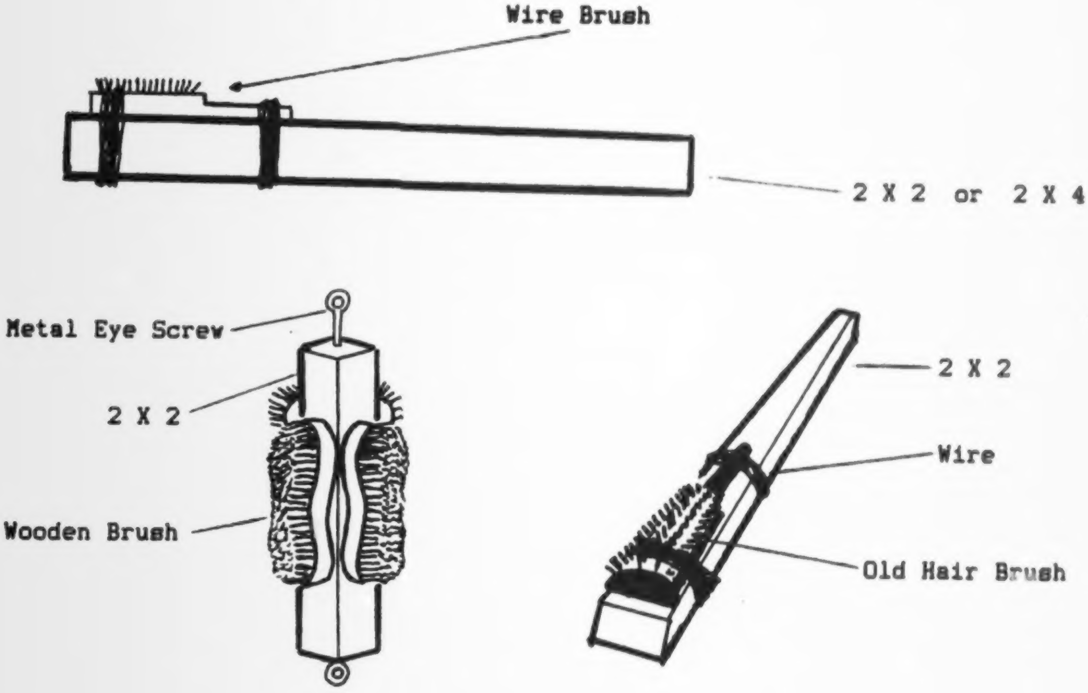


Figure 4.03. Homemade stove pipe brushes.

THE JOB: Cleaning Stove Pipe

CAUTION: MAKE SURE THE FIRE IS COMPLETELY OUT! Remove all ashes. Watch out for smoldering coals.

Step 1. Lay newspaper around stove to catch some of the soot. This is a messy job, so plan on getting dirty.

Step 2. Remove flue pipe from stove to ceiling. If this is not possible, remove just the section above the stove. If the pipe is one piece, disconnect it at the woodstove and move the stove. A screwdriver may be needed to loosen the pipe sections.

Step 3. Tape or wire the bag to the end of the flue pipe sticking into the room. Get it tight so soot does not leak out.

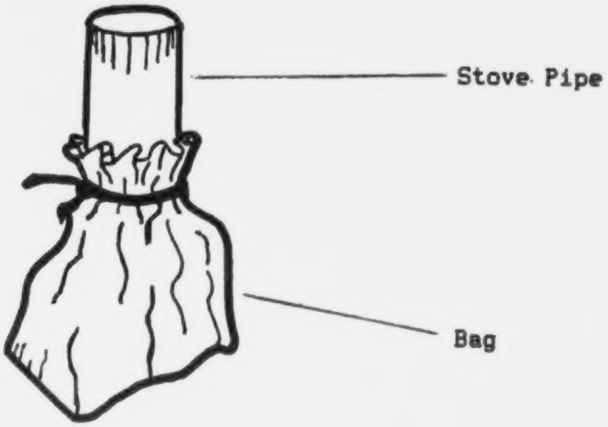


Figure 4.04. Clean the flue pipe well. Use a bag to catch the soot.

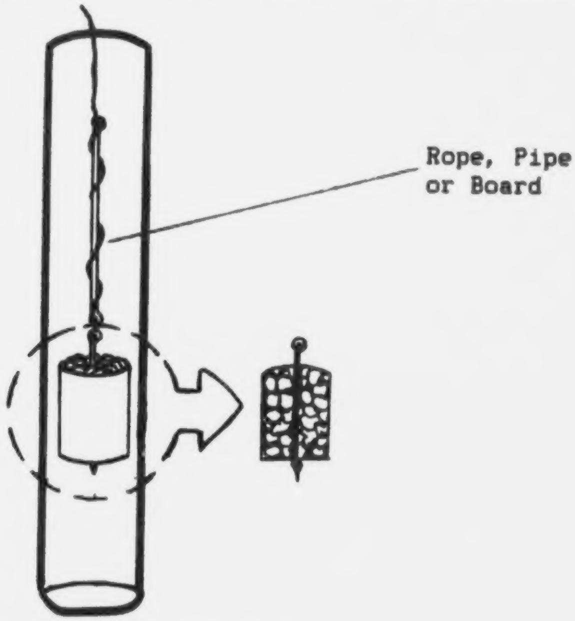


Figure 4.05. Use long enough rope, pipe, or board.

Step 4. Be sure that whatever is being used to clean the pipe will reach the entire length of the flue pipe from the roof.

Step 5. Take brush, rope (with weight) or pipe and gloves up on the roof and remove the chimney cap. The cap usually comes off by twisting and then lifting.

Step 6. Slide brush into and up and down the flue. Be careful not to puncture the soot bag below.

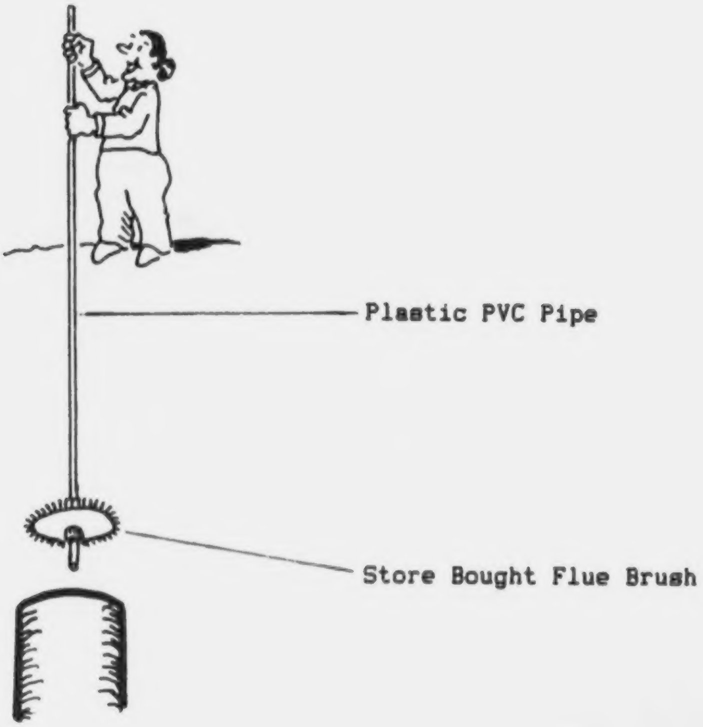


Figure 4.06. Cleaning the flue pipe.

Step 7. Look into the flue with a flashlight to be sure most of the soot has been removed.

Step 8. Brush out the chimney cap and screen. Replace them.

Step 9. Take the section(s) of pipe that have been removed outside to clean them. While inside, CAREFULLY remove the soot bag and throw it away.

Step 10. Put the clean flue pipe back together. Make sure all connections are tight.

CAUTION: Start a small fire in the stove and check for smoke leaks before starting a large fire.

APPLIANCES . . . . .Refrigerators/Freezers:

HINTS FOR BEST OPERATION: Refigerators and freezers are almost alike and are often combined into a single appliance. Like all appliances, they require maintenance. There are two basic types; "frost-free" and "manual defrost". The owner's manual will explain each operation. If there is not an owner's manual available, write the manufacturer and ask for one.

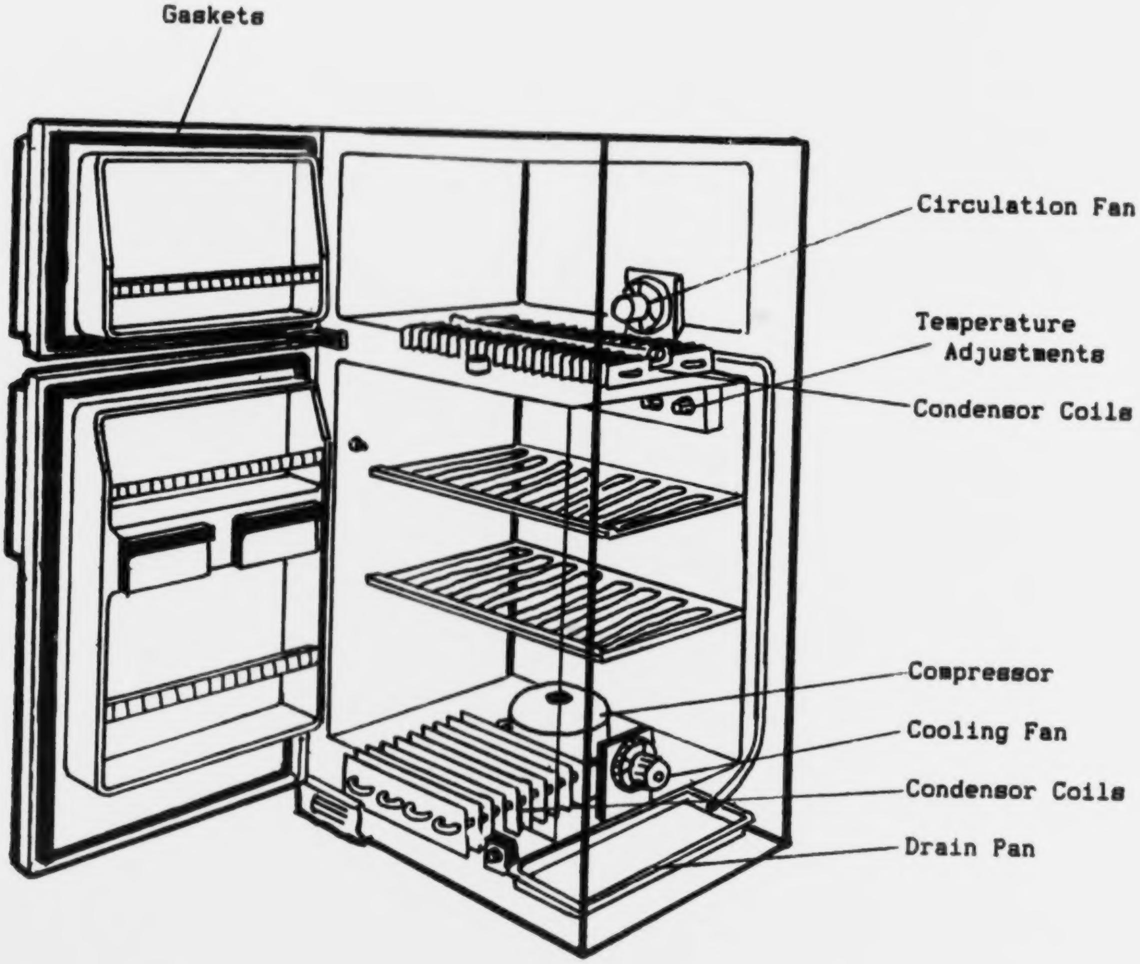

Gaskets
Circulation Fan
Temperature Adjustments
Condensor Coils
Compressor
Cooling Fan
Condensor Coils
Drain Pan

Figure 5.01. Refrigerator/Freezer.

DO:

1. Read the owner's manual and follow instructions.
2. Keep interior and exterior surfaces clean.
3. Perform regular maintenance jobs listed after this section of "dos" and "don'ts".

DON'T:

1. Let the kids use the door as a swing.
2. Set temperatures colder than necessary.
3. Put hot foods in the unit. Allow the food to cool first.
4. Put ordinary glass containers in the freezer. Use plastic.
5. Try to repair the electrical/mechanical systems.
6. Block the air flow vents in either unit with items.

REGULAR MAINTENANCE NEEDS:

1. Regular cleaning inside the refrigerator and freezer will help keep them from smelling. Include the gasket in regular cleaning. Use warm water and baking soda solution.
2. Empty and clean the drain pan(s) by sliding them out and washing in a warm soapy solution. Do not put plastic drain pans in the dishwater. Clean the drain pans about once a month.
3. Clear the drain holes with a coat hanger or screwdriver as needed.
4. Test the door gasket. If a new dollar bill will slip in and out easily at any point, the gasket needs to be replaced.

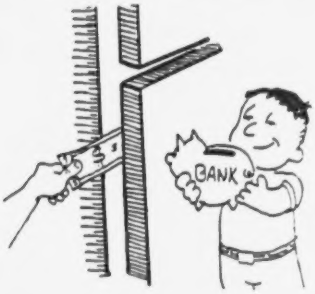


Figure 5.02. Energy saved here means money in the bank.

5. Vacuum the condensor every few months to keep dust from accumlating. This is the area in the back or at the bottom of the unit which must have good air flow around it.

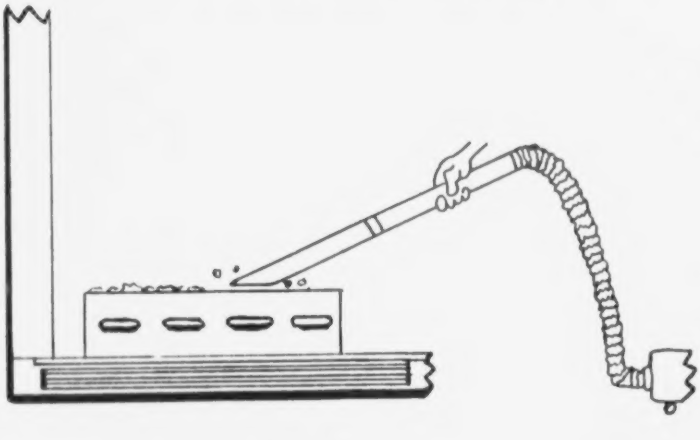


Figure 5.03. Clean Condensor Coils.

6. If dirt builds up in the condensor area, a wire or coat hanger may be needed to clean it. Gentle strokes should be made to prevent any damage to the unit.

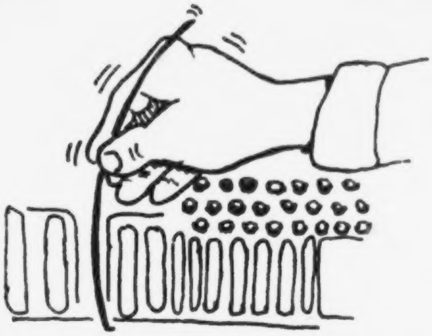


Figure 5.04. Get the hard to clean areas of the condensor coil.

7. Use a household thermometer (outside type) to check the refrigerator's temperature at least once a year. The refrigerator should be 37 degrees Fahrenheit, plus or minus two degrees either way. The freezer should be 0 degrees Fahrenheit.

CAUTION: If planning to inspect, clean or repair ANY electrical appliance, unplug or disconnect the unit from the power source.

COMMON PROBLEMS, CAUSES AND SOLUTIONS

CAUTION: Check the warranty to see what can or cannot be done. Some homeowner repairs can void the warranty.

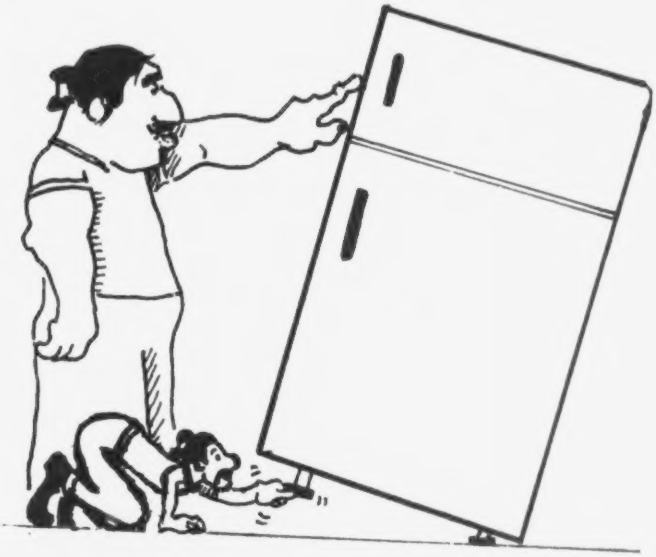


Figure 5.05. Adjust the legs to set level.

PROBLEM	POSSIBLE CAUSES	SOLUTIONS
Excessive vibration and/or noise.	Not level.	Raise or lower the legs with channel locks.
	Drain pan rattling.	Adjust it.
	Rubber mounts on the compressor are worn.	Replace the mounts. This may require a lot of time.
No sound, does not run.	No power at outlet.	Check outlet with a circuit tester or lamp. If there is no power, check circuit breakers or fuses. See the "Electrical" section of this manual for this procedure. If there is power, start with the cord and plug and inspect for bad parts. Use continuity tester and replace, if needed.
	Faulty temperature control or defective motor relay for the compressor.	Call a professional service person.
Not cooling or runs all the time.	Leaky door gasket.	Replace gasket.
	Condensor coils are dirty and clogged.	Clean out dirt and dust.
	Bad evaporator fan or defrost heater.	Seek professional service to recharge.
	Freon level low.	Seek expert help and service to have it recharged.

Know where the refrigerator/freezer can be repaired. The above steps outline only general maintenance.

HINTS FOR BEST OPERATION: Electric ranges and ovens are dependable for many years if kept clean and used properly. Refer to the "Electrical" section of this manual for basic testing procedures. Most homeowners prefer to leave the testing and repair of ranges and ovens to professional appliance service persons or electricians.

DO:

1. Read the owner's manual.
2. Clean the range top regularly with something that does not scratch the enamel paint.
3. Clean the drip pans below the burners or replace them regularly.
4. Use pots that lie flat on the range burner and are about the same size as the burner.
5. Clean up spills and cookovers immediately.
6. Keep pot handles turned over the cook top so children will not reach for and tip over hot pots and burn themselves.

DON'T:

1. Touch a burner to see if it is warming up. By the time it is about to turn red it can burn skin off.
2. Attempt to do a repair on the wiring.
3. Use the oven or range burners to heat the kitchen. Uncovered and exposed burners are dangerous. This is also very expensive.
4. Set racks in the oven too close to either top or bottom heating elements.
5. Loose the owner's manual.

CAUTION: Check the warranty to see what can or cannot be done. Some homeowner repairs can void the warranty.

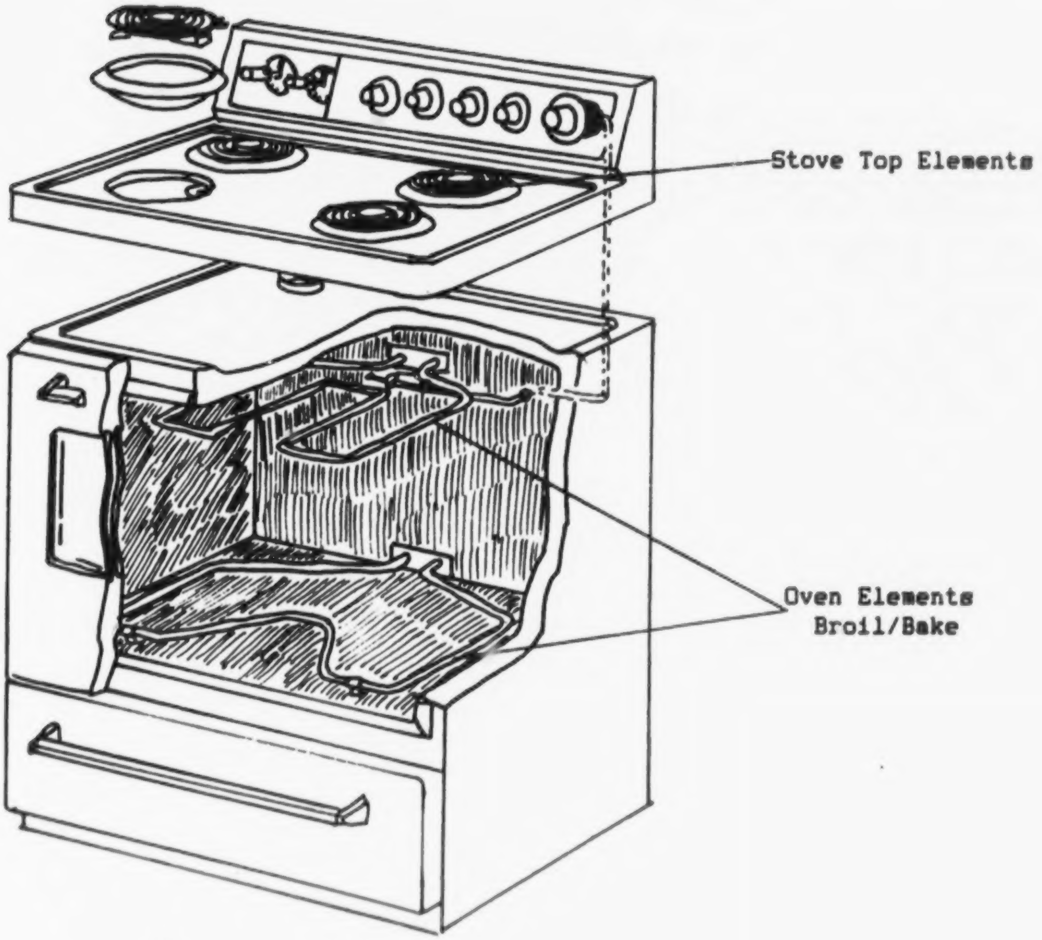


Figure 5.06. Typical electric range/oven.

REGULAR MAINTENANCE NEEDS

1. Keep EVERYTHING clean. If a commercial oven cleaner is used be careful. Follow the directions exactly.

CAUTION: The main ingredient in commercial cleaners is usually caustic lye that can burn the skin. The fumes can cause sickness.

2. Check the oven door every now and then to be sure the gasket is still good. Be sure the door closes tightly. The hinges are usually adjustable. Follow the directions in the owner's manual.

COMMON PROBLEMS, CAUSES AND SOLUTIONS

PROBLEMS	POSSIBLE CAUSES	SOLUTIONS
Range or oven does not work	No power to range/oven.	Check circuit breaker.
	Bad terminal block at the 3 prong plug.	Refer to the "Electrical" section for "Cord and Plug" repair.
	Oven control set to automatic turn on.	Follow owner's manual and reset control.
One element/burner does not work.	Bad element.	Have tested at repair shop and replace, if needed.
	Bad wiring to the element.	Seek professional service.
	Bad switch to the element.	Seek professional service.

PROFESSIONAL SERVICING AND PARTS

If anything goes wrong with the range's or oven's electrical system call for professional help. Simple testing and servicing is covered in the "Electrical Service" section in this manual. Ranges are not an appliance which you can easily remove and haul to the appliance repair shop, this will make service more expensive.

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HINTS FOR BEST OPERATION: Gas or propane range/oven units ARE USUALLY NOT appliances that homeowners can safely service and repair. Read the owner's manual carefully and follow directions exactly.

CAUTION: If there is a smell of gas in the area near the gas range/oven, and the pilot lights are manual, check all the gas pilot lights (flames), including the oven to make sure they are lit. If all are lit, turn off the gas shut-off valve immediately and call a service person. Make this phone call from a phone outside the home. DO NOT turn on ANYTHING electrical, even a light switch. Open windows and doors to air out the house.

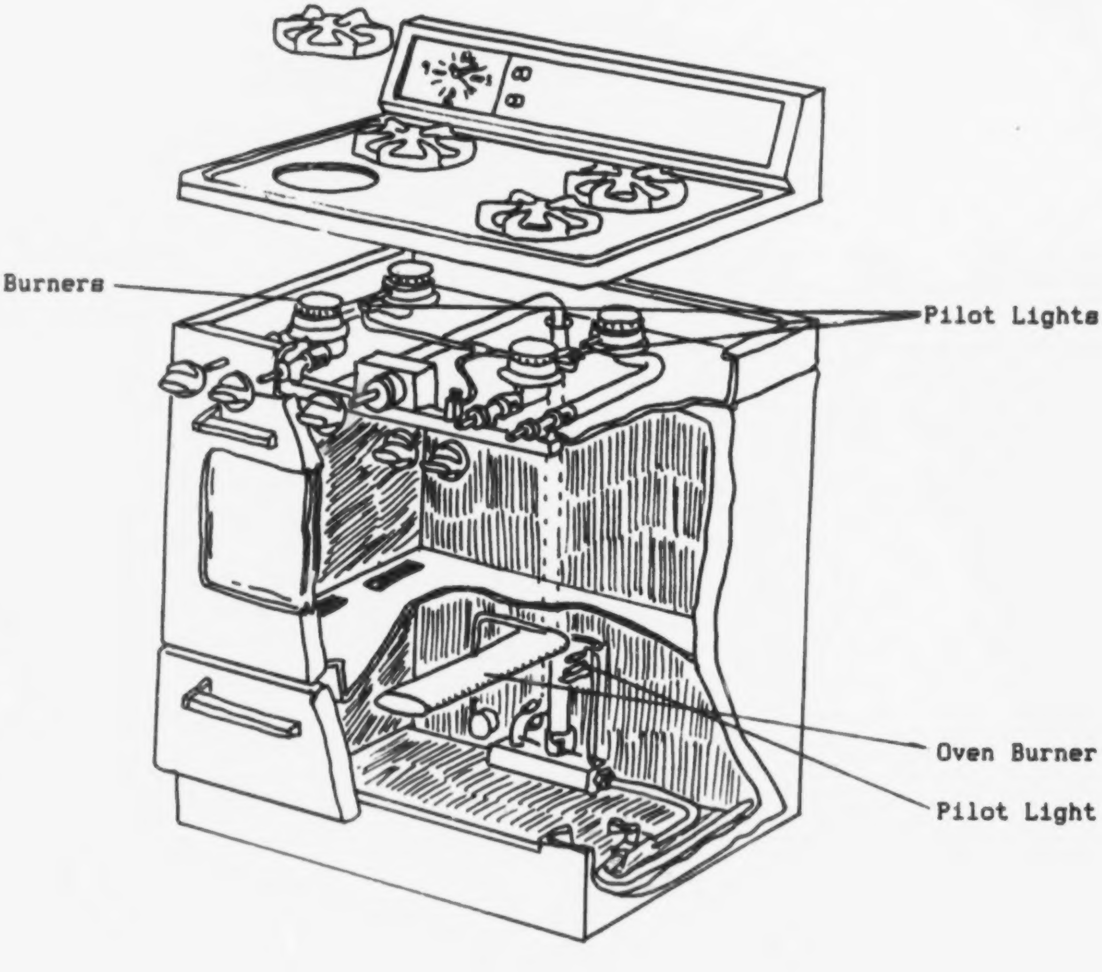

Figure 5.07. Typical gas range/oven.

CAUTION: Check the warranty to see what can or cannot be done. Some homeowner repairs can void the warranty.

DO:

1. Use pots that lie flat on the burner support and adjust the flame to fit the pan.

2. Clean up spills and cookovers immediately.

3. Keep pot handles turned over the cook top so children will not try to reach or tip over hot pots and burn themselves.

DON'T:

1. Use the oven or range burners to warm up your kitchen. Uncovered and exposed burners are dangerous. This is very, very expensive.

2. Loose the owner's manual.

3. Use a lighted match to look into the appliance when checking the pilot, or use a flashlight. This could cause an explosion.

REGULAR MAINTENANCE NEEDS

1. Keep EVERYTHING clean. If a commercial oven cleaner is used, be careful. Follow the directions exactly.

CAUTION: The main ingredient in commercial cleaners is usually caustic lye that can burn the skin. The fumes can cause sickness.

2. A gas flame should burn blue. If it is any other color, consult the owner's manual for adjustment or call a professional service person.

3. Check the oven door every now and then to be sure the gasket is still good. Also, be sure the door closes tightly. The hinges are usually adjustable. Following the directions in the owner's manual.

COMMON PROBLEMS, CAUSES AND SOLUTIONS

PROBLEMS	POSSIBLE CAUSES	SOLUTIONS
Burner does not light.	Pilot light is out.	Light it.
	Clogged burner holes.	Wash with warm water with soap and ammonia solution. Use tooth pick, paper clip or small wire to clean out the holes. Let dry thoroughly.

PROFESSIONAL SERVICING AND PARTS

Gas appliances of ANY kind present the possibility of explosion if not handled properly. If there is a gas smell, and where it comes from cannot be found, get help right away.

The supplier of gas, whether natural gas or bottled gas, can service the equipment or tell who can help. Keep their phone number handy.

HINTS FOR BEST OPERATION: Be careful not to use too much soap in the machine. Read both the owner's manual and the soapbox. Do not stuff so many clothes in that the machine is overloaded. If the machine has a filter, it needs to be cleaned after every load. Wash similar types of clothes together. Read the owner's manual for regular maintenance of filters and screens.

CAUTION: Check the warranty to see what can or cannot be done. Some homeowner repairs can void the warranty.

COMMON PROBLEMS, CAUSES AND SOLUTIONS

PROBLEMS	POSSIBLE CAUSES	SOLUTIONS
Washer will not run at all.	Cord unplugged.	Check to see that it is plugged in.
	No power to outlet where the machine is plugged in.	Try a lamp or other appliance that is known to work in the outlet where the washer is plugged in. If there is no power, check the circuit breaker for that outlet.
	Lid not closed.	There is a safety switch that stops the machine when the lid is lifted. If the lid does not close all the way, or if the switch goes bad, the machine will not run.
	Controls not properly used.	Consult the owner's manual.
No hot water or no water at all.	Faucets turned off.	Supply hoses are connected to faucets that can be turned off to move or fix the machine. Make sure they are on.
	Hoses kinked or crimped.	Check to see that there are no sudden bends that pinch the water supply hoses or something that is crushing the hose(s).

PROBLEMS	POSSIBLE CAUSES	SOLUTIONS
	Hose screens clogged.	At one end or sometimes both ends of the supply hose, there is a strainer to keep dirt from going into the machine's pump and parts. Sometimes the screen is in the machine where the hose connects. Turn off the faucets and disconnect the hoses. (Some water may come out but not too much). Remove the little screens and clean them. Put them back in and reconnect the hoses. Turn the faucets back on and check carefully for any leaks.
Washer will not drain.	Drain hose kinked.	Be sure that the hose is not twisted or bent.
	Lid not completely closed.	A lid not closed all the way will keep the machine from running. Close it.
Leaking onto the floor.	Loose supply hose connections.	Tighten them. If still leaking, replace the washers in the hose.
	Drain hose has slipped out of the drain.	Put it back securely.
	Machine is overloaded.	Remove some clothes and dip some water out. Then restart the machine.
	Machine has too many suds.	Add cold water and 1/2 cup of white vinegar to reduce the suds. When the wash is done, rinse the tub out.
Machine slows down or stops in the middle of a wash.	Load on one side of the tub.	There is a switch to slow down or stop the washing machines when the load is out of balance. Move the clothes around in the machine and restart.

PROBLEMS	POSSIBLE CAUSES	SOLUTIONS
Too much lint on clothes.	Dirty lint filter.	Refer to the owner's manual to find out how to clean the filter.
	Mixing different types of clothes.	Do not mix lint-giving clothes (towels, etc.) with lint-attracting items such as synthetics like dacron and polyesters.
Machine vibrates.	Load out of balance.	Balance load by moving clothes around.
	Machine not level.	Check level and adjust all legs for firm contact with the floor.

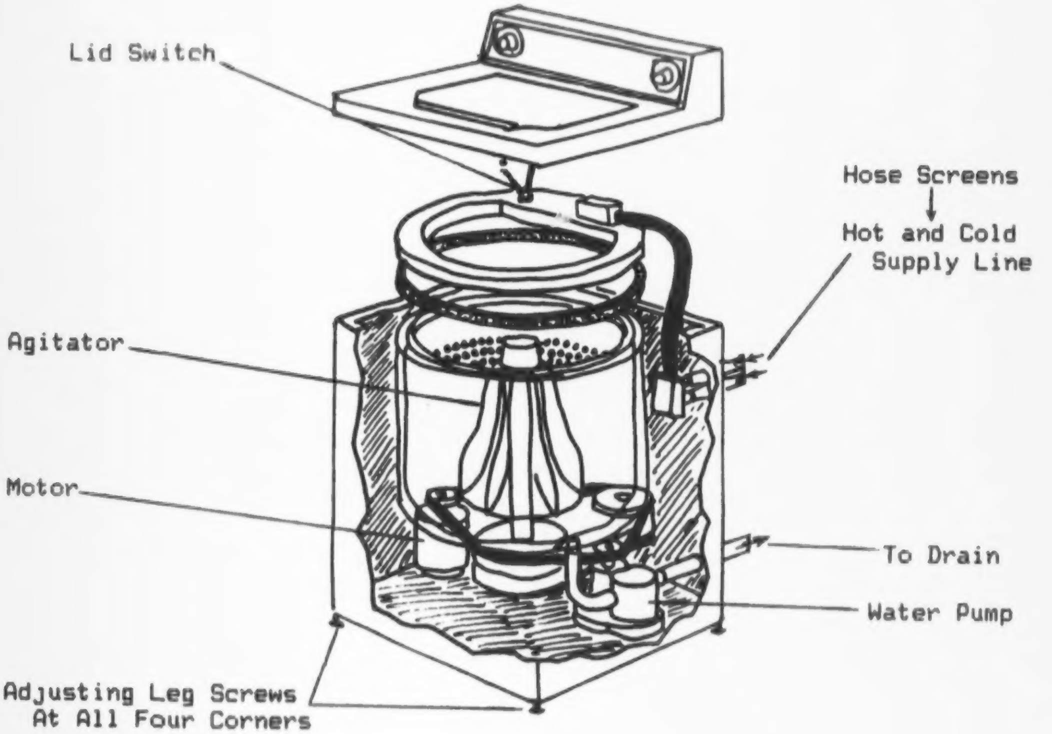
Lid Switch
Hose Screens
Hot and Cold Supply Line
Agitator
Motor
To Drain
Water Pump
Adjusting Leg Screws At All Four Corners

Figure 5.08. Typical washing machine.

PROFESSIONAL SERVICING AND PARTS

If anything goes wrong with the washer's electrical or mechanical systems, get professional help. This manual's section on "Electrical Service" can show how to test some parts such as switches.

Parts must fit the machine. Start searching for parts with a store that sells the same brand of machine. Major manufacturers have phone numbers to call to find nearby help. Although washing machines are heavy and difficult to move, it may be cheaper to take it to an expert to be repaired than to replace it.

HINTS FOR BEST OPERATION: As appliances go, dryers last a long time and require very little maintenance if the manufacturer's directions are followed. Do not put plastic or rubber things in a dryer with the heat on. Clean the lint filter before EACH use. Wipe inner and outer surfaces clean and follow other directions in the owner's manual. Keep the owner's manual where is can be found.

CAUTION: Check the warranty to see what can or cannot be done. Some homeowner repairs can void the warranty.

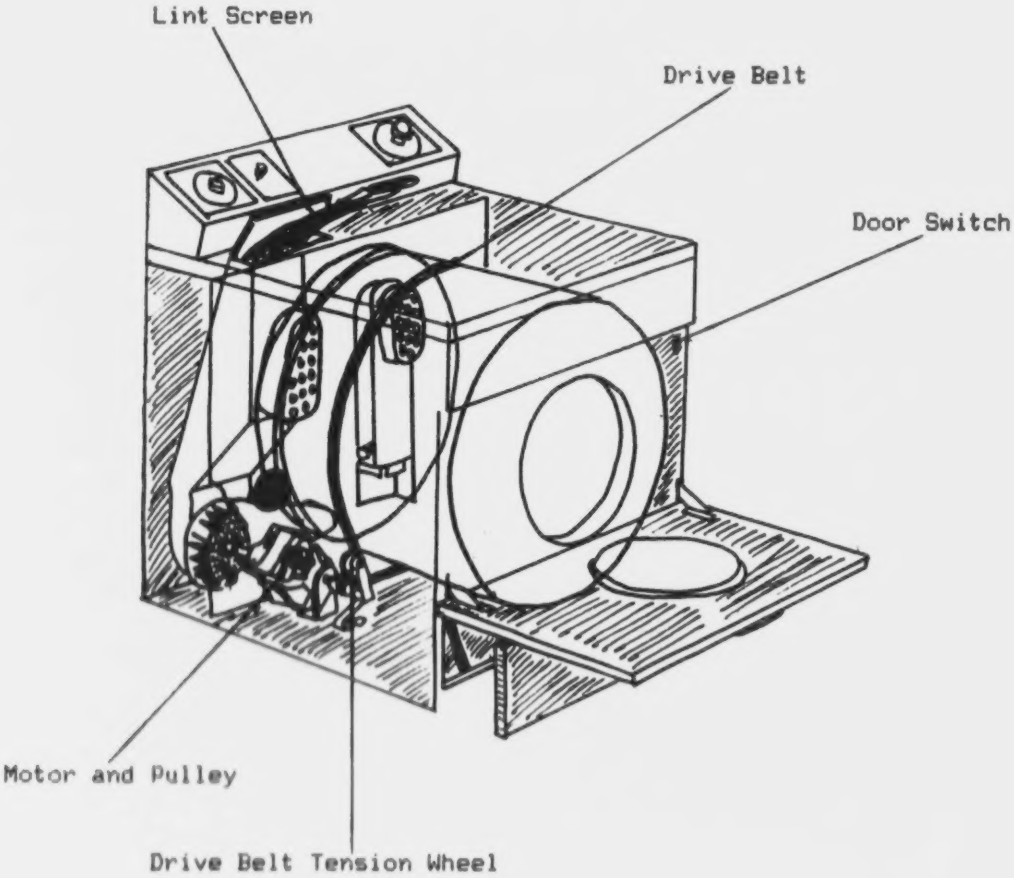

Figure 5.09. Typical electric dryer.

COMMON PROBLEMS, CAUSES AND SOLUTIONS

PROBLEMS	POSSIBLE CAUSES	SOLUTIONS
The dryer heats up and the drum turns but the clothes remain damp.	Dryer is overloaded.	Put fewer clothes in the dryer.

PROBLEMS	POSSIBLE CAUSES	SOLUTIONS
	Wrong cycle selected on the controls.	Check the owner's manual and be sure to select the recommended heat setting.
	Lint screen clogged.	Remember to CLEAN IT EACH TIME the dryer is used. Some clothes create more lint than others.
	Vent pipe flap, outside the house is not opening.	Turn the dryer on and check to be sure the flap is open. Use a light oil or silicone lubricant on the flap.
	Lint has built up in the vent pipes.	Even with a lint screen, after enough time lint can build up in the system. Take the vent pipes apart and clean them with rags. Reassemble the pipes using duct tape around every joint to seal.
	Dryer is turning off too soon.	If it seems that the dryer is not running as long as it used to, the timer or electronic sensors need repairing or replacing. This is a job for an appliance repair person.
Motor is heard running, but the drum does not rotate.	A broken drum drive belt.	Depending on the type of dryer, replacing the drive belt can be easy or next to impossible. Check the owner's manual to see what is recommended. Replacing it will require taking off part of the outside of the dryer. The edges of the metal can be sharp! To replace a belt, release the spring tension wheel, and work the new belt onto the drum and pulley. Be sure to purchase the right belt by taking the model number of the dryer when buying a new belt, or take the old belt.

PROBLEMS	POSSIBLE CAUSES	SOLUTIONS
	Set screw on pulley is loose.	Pulleys are often held by a set screw. If the screw works loose from the shaft, the belt will not be driven correctly. To check this, remove a section of the outside of the dryer. Move the dryer to see if the motor spins but the pulley does not turn. Tighten or replace, if it is missing the set screw.
No heat but the drum rotates.	The cause is usually electrical and will require a service person.	Check to see if there is a blown fuse or circuit breaker. If after replacing the fuse or resetting the circuit breaker, it happens again, call a service person.
The dryer will not run at all.	Fuses or circuit breakers.	If the fuses or circuit breakers keep giving up, it is time to call the service person.

PROFESSIONAL SERVICING AND PARTS

If anything goes wrong with the dryer's electrical system, especially if the fuses or circuit breakers keep "blowing", call a professional service person.

Parts must fit the machine. Start the part's search with the dealer for the machine. All major manufacturers have phone numbers call for local service. Some service work can be done in the home, but it may be less expensive to take the dryer to the shop.

HINTS FOR BEST OPERATION: Electrical baseboard heaters are probably the simplest and most dependable of heating systems. In areas of high electric costs, however, they can be quite expensive to operate. It is important to follow the "dos and don'ts" list to keep the heaters operating well and safely.

DO:

1. Read and follow the owner's manual instructions.
2. Brush and/or vacuum the heating unit(s) to prevent dust build up.
3. Turn off units in rooms not being used.
4. Consider an automatic set-back thermostat if the heaters are controlled by a wall-mounted, central thermostat.
5. Call for an electrician if the heater fails to work or if any circuit breakers or fuses, controlling power to the heater, keeps going off.

DON'T:

1. Dry shoes, clothes, towels, etc. by placing on the baseboard units. Plastics will melt and cloth items can smolder into a fire.
2. Expect baseboard systems to warm up a house fast.
3. Operate the heaters if the circuit breakers or fuses keep going off.
4. Allow furniture or curtains to be in direct contact with the heating unit.

REGULAR MAINTENANCE NEEDS

1. Keep heaters clean and vents or spaces in the unit clear.
2. Blow dust from central thermostat.

COMMON PROBLEMS, CAUSES AND SOLUTIONS

PROBLEMS	POSSIBLE CAUSES	SOLUTIONS
No heat	Electricity off because the bill was not paid.	Call the power company and arrange to pay the bill.
	Fuses or circuit breakers are opened (blown).	Reset or replace. If it happens again, call an electrician.
Odors.	Dust in unit.	Clean it.
	Organic materials (decaying odors).	Clean it. If necessary remove the cover to check for things like dead mice.
High electric bills.	Heat too high.	Set temperature lower. If necessary wear more clothing.
	Heat on when no one is home.	Install automatic thermostat to lower heat when no one is home.
	Dirty heaters.	Clean them.
	Other electric appliances such as hot water heaters might be responsible for the high electric bills.	Timers can be installed to to lower bills.

HINTS FOR BEST OPERATION: Gas wall heaters are fairly simple heating systems. The heater should be kept clean and checked frequently. The flames of the heater burner should have a soft, blue-green inner flame. The heater requires electricity to run the fan.

CAUTION: Most service of gas wall heaters should be left to professionals. If there is a gas smell in the area, check the pilot light. If the pilot is out, open windows to ventilate the area. Then, relight as per owner's manual or this manual.

CAUTION: If the gas smell exists but the pilot light is on, shut off the gas to the unit and call for professional service immediately. Use a phone outside the home for this call. Air the whole house and MAKE NO SPARKS or turn on electric switches.

DO:

1. Vacuum the unit to keep dust and dirt clear, often.
2. Check and change the air filters frequently.
3. Read the owner's manual, follow all instructions and SAVE THE MANUAL.

DON'T:

1. Use a lighted match to inspect the pilot/burner area; use a flashlight.
2. Light the pilot without first airing out the entire area thoroughly.

REGULAR MAINTENANCE NEEDS

1. It is best to buy filters by the case to get the best price and to always have one available.
2. Filter replacement and/or cleaning depends on how dusty the air is. Filters can be cleaned by vacuuming or blowing air through them backwards. Consult the owner's manual. Replace filters as needed.

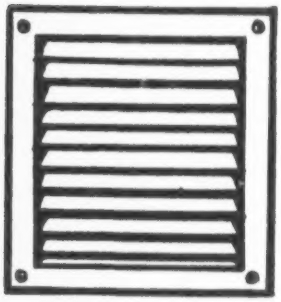

Figure 5.10. Filter Cover Grate.

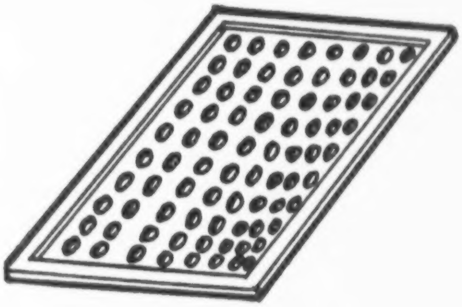

Figure 5.11. Typical Filter.

PROBLEM: Fan does not operate or is noisy when running.

INFORMATION: Stove top exhaust fans and bathroom fans are the most common types of fans in a modern house. All fans are basically the same, even portable fans. The blades must be in good balance with bearings properly oiled or there will be noise.

TOOLS AND MATERIALS:

Screwdrivers

Wrenches

Oil can or spray lubricant

Electrical tape

Knife

THE JOB: Getting fan to run.

Step 1. Blown fuse or tripped circuit breaker. Check circuit with voltage tester or a working lamp.

Step 2. Power cord faulty on portable fan. Check cord and plug for fraying or loose connections.

Step 3. Faulty switch. Check with voltage tester for power at the switch and then at the motor. If the switch gets power, but there is no power at the motor, the switch is bad. Replace it.

Step 4. Faulty motor; there is voltage present but the motor does not turn. The motor will probably need to be replaced.

THE JOB: Correcting vibration or noise.

Step 1. Parts need lubricating. Check the owner's manual because some fans can't be oiled. Use a silicone spray lubricant if there are no holes marked "oil".

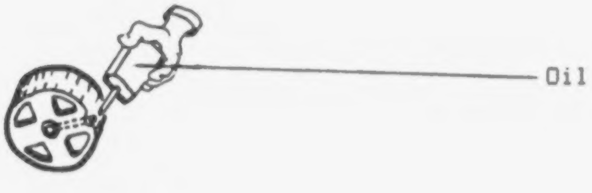

Figure 5.12. Oil moving parts.

Step 2. Loose fan parts. Watch and listen carefully while the fan runs. Turn it off, unplug, and tighten up parts where possible.

Step 3. Bent blades. Check for bent blades as shown. Fix by unplugging fan, disconnecting blades and carefully bending until all blades are even.

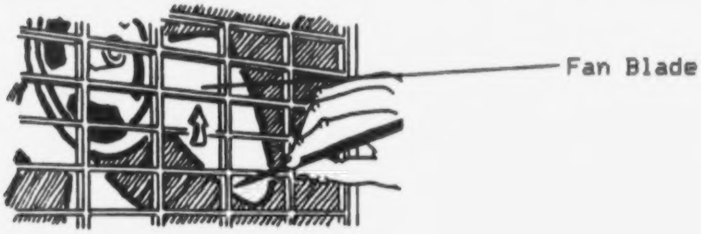

Figure 5.13. Adjust bent fan blades.

THE JOB: Stopping electrical shocks from fan.

Step 1. DO NOT OPERATE.

Step 2. Check cords and plugs for obvious shorts or get professional servicing.

HINTS FOR BEST OPERATION: Whether gas-fired or electric the water heater has some regular maintenance needs. Many homeowners neglect care of this unit and have to replace the water heater long before they should. Take care of the water heater and it will keep on working for a long time.

DO:

1. Read the owner's manual and save it.
2. Perform regular maintenance as required.
3. Utilize conservation techniques as suggested in the "Insulation and Conservation" section of this manual.

DON'T:

1. Expect CONSTANT hot water, all water heaters have a recovery period.

REGULAR MAINTENANCE NEEDS

1. Once every month, open the drain cock (valve) at the bottom of the tank and drain off a pan full of water to remove sediment.
2. Every six months, for gas water heaters, shut off the gas. Check air shutter's openings and the exhaust vent for any blockages. Check the burner for rust, dust and dirt. Brush and/or vacuum any built up dirt.
3. Once every year, shut off the power or gas to the water heater. Attach a garden hose to the drain valve and open the valve to totally drain the tank. This "flushing" procedure will help remove scale, sediment and rust.

COMMON PROBLEMS, CAUSES AND SOLUTIONS

PROBLEMS	POSSIBLE CAUSES	SOLUTIONS
ELECTRIC WATER HEATER:		
No hot water.	Fuses or circuit breaker "open".	Replace fuses or reset breakers. If the problem happens again call, an electrician. Push reset button on the upper element if so equipped. Test power to elements and replace if needed as per this manual or the owner's manual.

PROBLEMS	POSSIBLE CAUSES	SOLUTIONS
Not enough hot water.	Set at low temperature	Reset thermostat higher.
	Worn out element or thermostat.	Test both elements and thermostat as indicated in other sections of this manual. Replace if needed.
	Too much hot water being used at one time.	Spread out water use over a period of time.
	Leaking hot water lines and faucets.	Find and repair.
Water heater leaks.	Leakage around gasket to heating element(s).	To check, remove the cover, spread some insulation apart, and inspect the area where the element is bolted to the tank. If water is leaking, first try tightening the element mounting bolts. If that does not help, replace the element gasket. There is another section in this manual which covers this job.
	Leaks at pipe fittings or drain valve.	Tighten fittings and/or replace. See the "Plumbing" sections in this manual.
	Pressure/temperature relief valve leaks.	In some types of water heaters some overflow can be expected. Place a bucket under the outflow of the relief valve, open the valve manually, CAREFULLY, and close it. If this does not stop the discharge, unplug the power. Drain tank, this a good time to clean out sediment, and replace the relief valve.
Water heater puts out discolored hot water	Sediment buildup.	Drain and refill as noted earlier in this section.
	Anode rod not preventing corrosion.	Unbolt the anode rod and replace if badly worn.

PROBLEMS	POSSIBLE CAUSES	SOLUTIONS
	Elements are encrusted with scale.	Shut it off and drain the tank. Remove the elements and clean them. Reinstall the elements and check for leaks.
	Plumbing pipe is corroded.	Call a plumber to check.
Hot water heater is noisy.	Too much sediment in the tank.	Flushing is needed.

PROBLEMS	POSSIBLE CAUSES	SOLUTIONS
GAS WATER HEATER:		
No hot water.	Out of gas.	Check the tank or gauge and see if other gas appliances are working. If out of gas, shut off each appliance, resupply tank, relight as instructed by the owner's manual or other sections of this manual.
	Pilot light is out.	Relight following instructions of the owner's manual or other sections of this manual. If pilot light will not ignite, call a professional service person.
Not enough hot water.	Set at low temperature.	Reset thermostat a bit higher.
	Burner is fouled.	Call for repair service.
	Faulty thermostat.	Call for repair service.
Water too hot	Temperature control set too high.	Set lower.
	Thermostat faulty.	Call repair person.
Hot water heater is noisy.	Too much sediment in the tank.	Flushing is needed.
	Burner is dirty, or out of adjustment.	Clean burner, or get a professional service person to adjust.

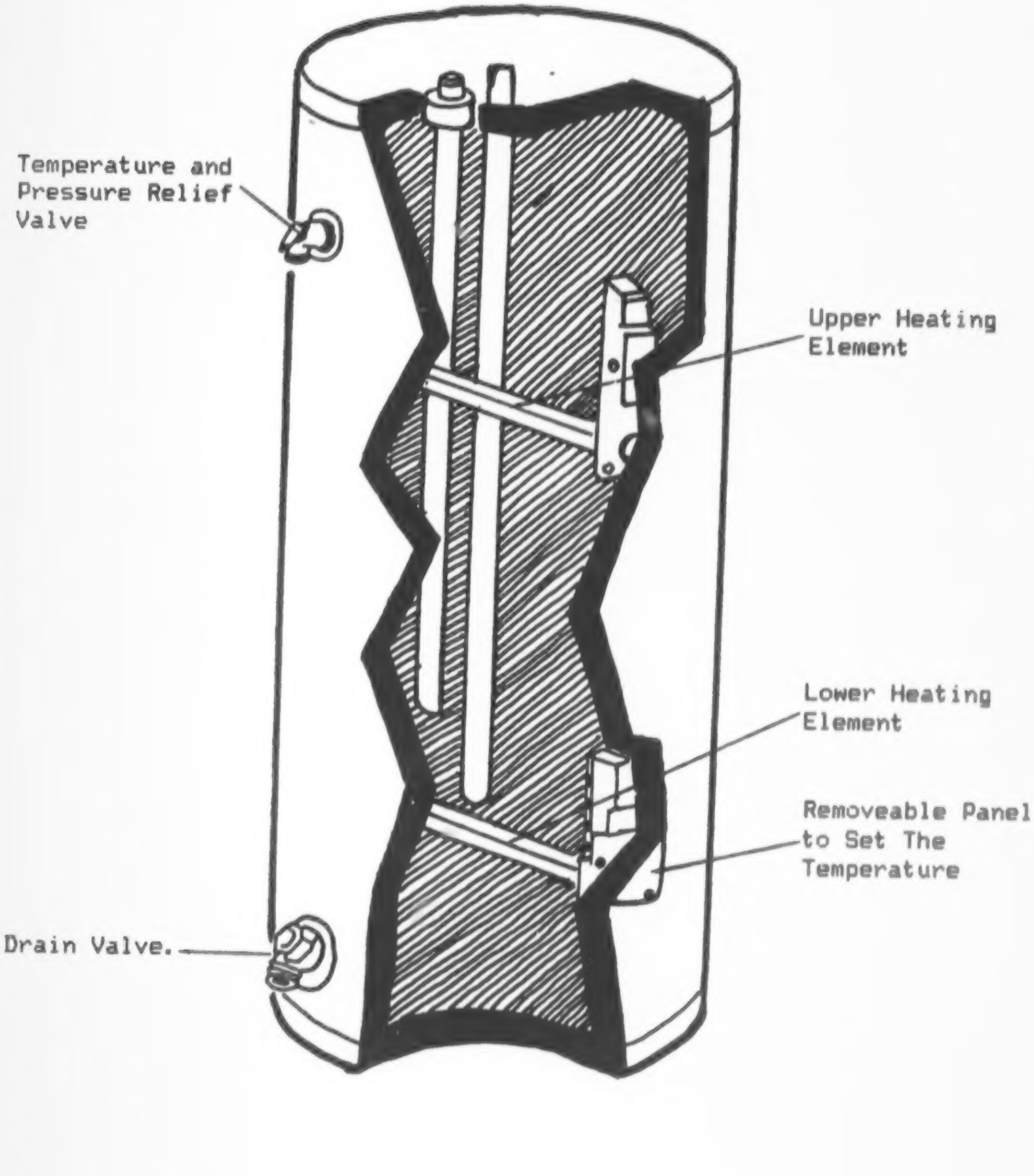
Temperature and Pressure Relief Valve
Upper Heating Element
Lower Heating Element
Removeable Panel to Set The Temperature
Drain Valve.

Figure 5.14. Typical electric hot water heater.

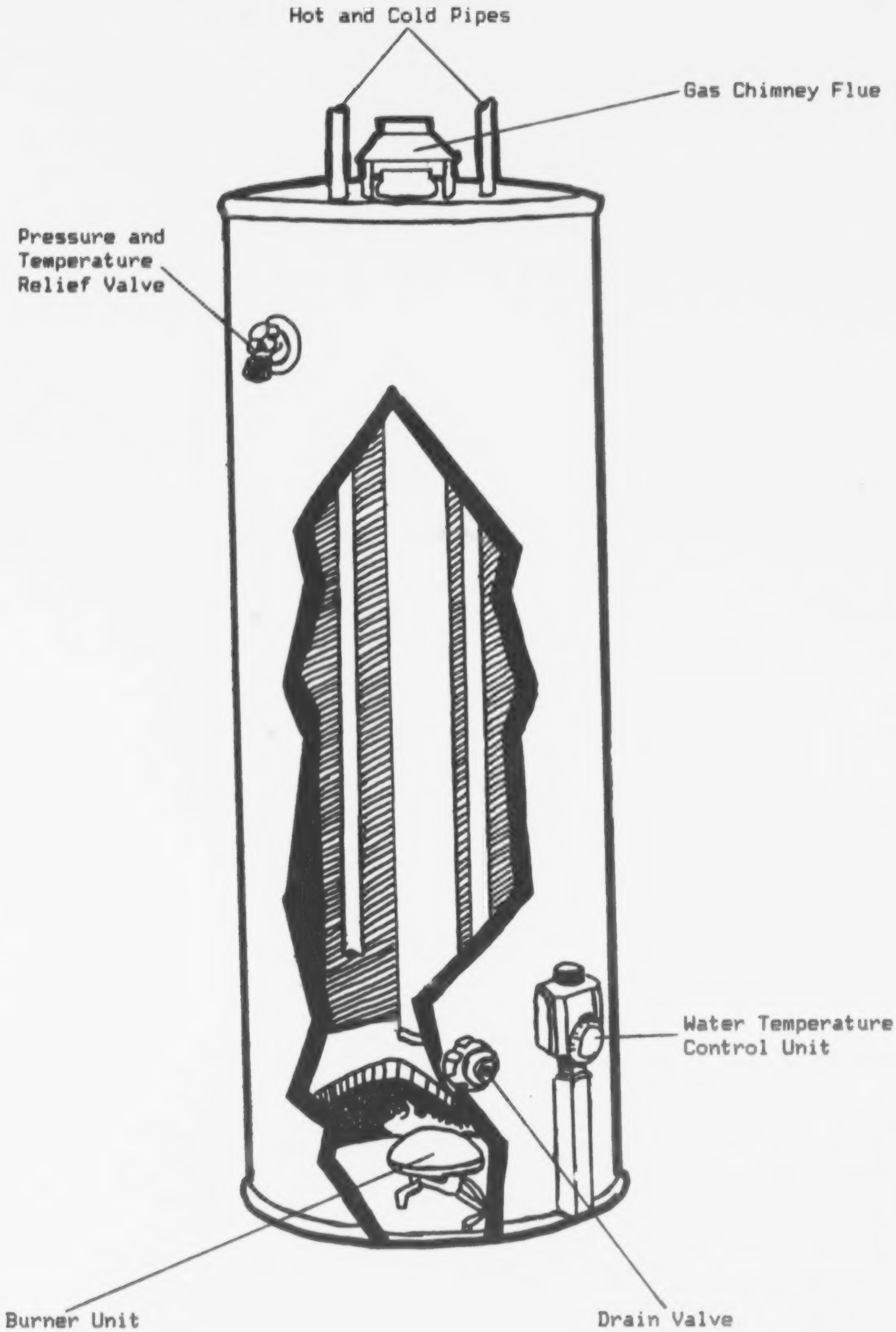
Hot and Cold Pipes
Gas Chimney Flue
Pressure and
Temperature
Relief Valve
Water Temperature
Control Unit
Burner Unit
Drain Valve

Figure 5.15. Typical gas hot water heater.

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PROBLEM: Setting water heater temperature control for energy savings without running out of hot water.

INFORMATION: Hot and cold water are mixed together for many uses in the home. Examples are bathing and washing dishes or clothes.

1. What is the hottest water temperature needed?

   A. For an automatic dishwasher, most manufacturers recommend the water temperature be 140 degrees because that is hot enough to kill most kinds of common bacteria.

   B. For washing dishes by hand, 140 degrees is too hot to handle. If dish washing is done by hand, but wash clothes are washed in an electric washing machine, then about 120 degrees is good.

   C. If the dishwashing and the clothes washing is done by hand then a setting of 110 degrees will be hot enough.

   REMEMBER: By using the lowest temperature that will meet the needs, the more gas or electricity will be saved. This will reduce the energy bill.

2. When deciding on the maximum temperature also ask if there is enough hot water to meet the families needs? There are four things to do if hot water runs out often:

   A. Allow more time between major uses such as showering, washing dishes, and washing clothes. This lets the hot water heater heat more water.

   B. Set the temperature control to a higher setting. Do so gradually over a few days and see if that keeps enough hot water.

   C. If neither of these approaches work refer to the "Hot Water Heater: Safety and Maintenance" section of this manual to see if the appliance needs repair.

   D. If this fails to solve the problem, consider replacing the present water heater with a model which heats water faster or a larger water heater.

THE JOB: Finding the proper settings for hot water heater.

Step 1. Refer to the water heater owner's manual for the manufactur's recommendations. On models which have no numbers on the temperature dial there may be "low", "medium", and "high" settings. Refer to the owner's manual to see what temperatures these are.

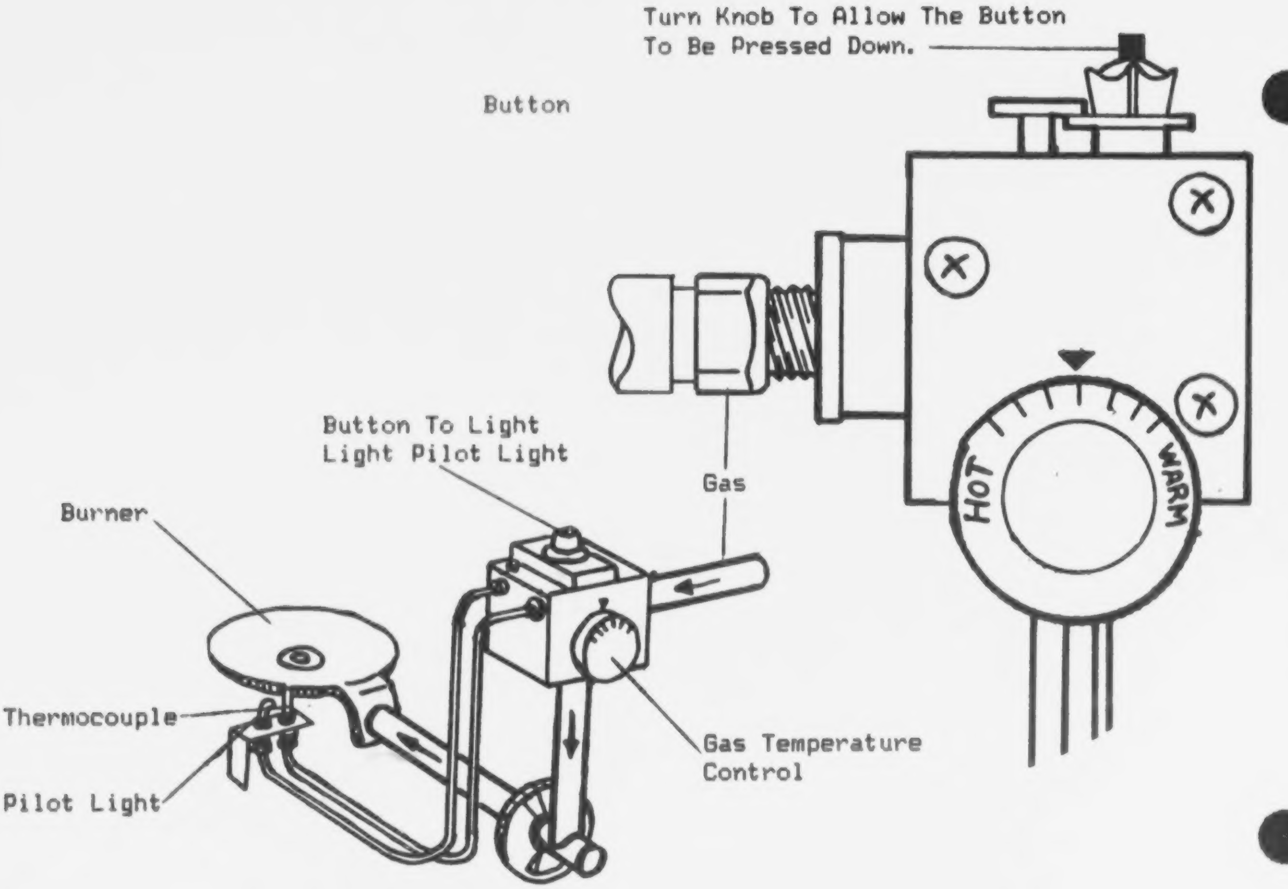
Turn Knob To Allow The Button
To Be Pressed Down.
Button
Gas
HOT
WARM
Button To Light
Light Pilot Light
Burner
Thermocouple
Pilot Light
Gas Temperature
Control

Figure 5.16. Typical gas burner/pilot light.

Step 2. To test the water, use a thermometer with a temperature range of 90 degrees to 160 degrees. Let the water run out of a faucet until it does not get any hotter. Hold the bulb of the thermometer in the water for about one minute. Check the temperature reading. Reset the temperature control, if necessary, and recheck the temperature after two hours.

Step 3. Most water heater controls are behind a cover plate of sheet metal or plastic. Sometimes these can be tricky to remove. If so, check the owner's manual.

Step 4. Make any adjustments gradually over a few days to average out your use.

PROFESSIONAL SERVICING AND PARTS

If after adjusting the temperature control, there does not seem to be any effect on the temperature, it may be necessary to replace some of the heater parts. This is a job that should be left to the service people, especially if the water heater is heated by natural gas or propane. Contact the supplier or manufacturer of the unit to locate authorized help. It may affect the warranty if repairs are done by the homeowner.

PROBLEM: Electric hot water heater elements are not working. Note: it is rare for BOTH elements to fail at the same time. If this should happen check the section of "Hot Water Heater: Safety and Maintenance" in this manual.

INFORMATION: Elements do fail. More often they become encrusted and cannot be cleaned satisfactorily. In an electric hot water heater, there is an element at the top and one at the bottom. Where they enter the water tank, a heat resistant gasket is used to prevent leaks.

TOOLS AND MATERIALS:

Screwdrivers

Adjustable wrench

Replacement element(s). Take the old element when buying the new one.

THE JOB: Replacing elements in a hot water heater.

Step 1. Remove the cover plate. Put the screws where they will be easy to find later.

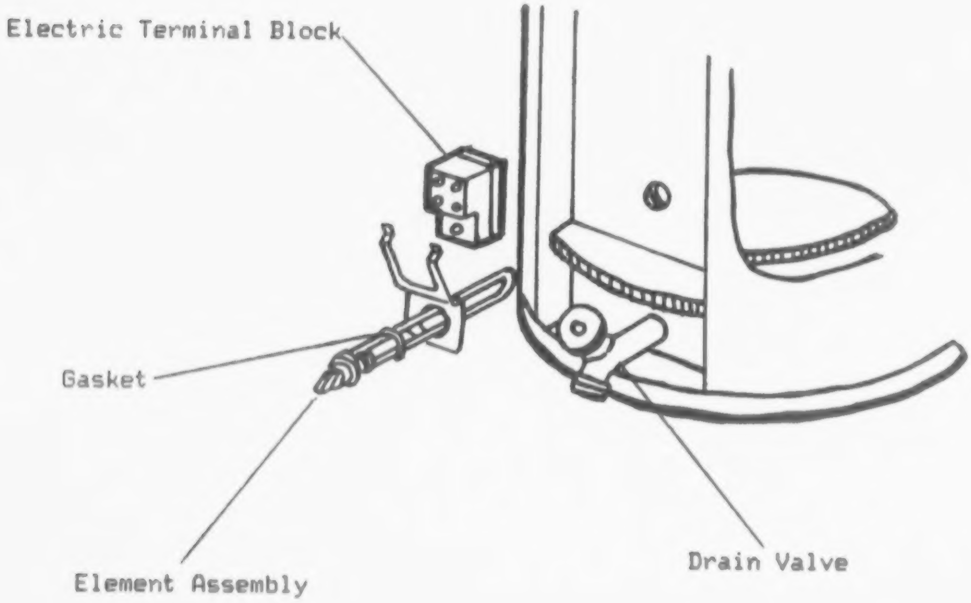

Figure 5.17. Electric water heater element.

Step 2. Turn off the cold water supply to the hot water heater. A valve is usually located at the top of the tank for shutting off the water supply. Turn off the electricity or gas power.

Step 3. Disconnect the electrical wires from the terminal block to the element.

Step 4. Unscrew the element(s). Some are screwed into the tank, others are fastened by bolts or screws.

Step 5. Take the element(s) to a plumbing supply store and find the proper replacement(s) parts for the hot water heater.

Step 6. Install the new element. Be sure the gasket seals firmly.

Step 7. Turn the drain valve to "off". Turn on the cold water supply to the tank. Open the hot water faucets in the house to let out air. Leave them on until the water quits spurting.

Step 8. Inspect the area around the new element to be sure there are no leaks.

Step 9. Turn on the electrical power at the circuit breaker or fuse box. Allow the water heater a couple of hours to heat the water.

Step 10. Check again for leaks after the water in the tank has heated up.

APPLIANCES .HOT WATER HEATER: REPLACEMENT

PROBLEM: Water heater tank leaks, has considerable corrosion or has deteriorated elements and controls.

INFORMATION: It is sometimes cheaper to replace the water heater entirely than to replace parts. If the tank is corroded or leaks, it must be replaced.

TOOLS AND MATERIALS:

Wrenches, adjustable and pipe wrenches

Screwdrivers

New water heater

CAUTION: If there is a natural gas or propane water heater, call an expert for service.

THE JOB: Replacing the electric hot water heater.

Step 1. Turn off power to unit at the circuit breaker panel.

Step 2. Turn off the cold water supply to the unit. Usually there is a valve at the top of the unit for doing this.

Step 3. Open house hot water faucets to relieve line pressure. Then, close the faucets.

Step 4. Make a sketch of how the power and water is connected.

Step 5. Disconnect electrical power lines to the unit. Check first with a voltage tester to be sure the power is OFF.

Step 6. Disconnect the water lines to the old unit.

Step 7. Remove the old water heater.

Step 8. Follow the replacement unit instructions that came with the hot water heater, hook up the water and power to it. Refer to the sketch made earlier.

Step 9. Open all hot water faucets in the house. Turn on the cold/hot water lines to and from the tank. When the air has come out, close the faucets.

Step 10. Check for leaks at all connections.

Step 11. When the tank is full of water, turn on the power. Check all connections again for leaks.

PROBLEM: Hot water heating is surprisingly expensive. In a typical house 40 percent or more of the energy bill can be for heating water. There are several things a homeowner or renter can do to reduce these costs.

INFORMATION: Most newer water heaters have increased tank insulation and other energy saving features. Still that may not be enough if the water heater is outside of the heated space of the house. When considering the tank temperature is 110 to 140 degrees and the house is not nearly that hot, a water heater constantly loses heat to the air around it. Besides increased insulation there are many factors or improvements that can be consided.

THE JOB: Saving energy and money.

Step 1. The water heater should be clean and in good working order. It should also be large enough to do the job, but not so large as to waste energy heating water not used.

Step 2. Drain water and sediment several times a year to prevent build-up. Refer to the "Hot Water Heater: Safety and Maintenance" section.

Step 3. Check the water and tank area frequently for problems such as hot water discoloring, sudden change to cold only when in use, and leaks.

Step 4. Leaky (dripping) hot water faucets waste money. Refer to the "Plumbing" sections of this manual to fix.

Step 5. Use the lowest temperature setting that will provide enough hot water. Refer to "Hot Water Heater: Controls/Settings" section of this manual.

Step 6. Install "water-savers" (flow reducers) in all faucets and showerheads. These low cost washers with holes can save a lot.

Step 7. Reset the temperature lower for periods of days when no one will be home. If it will be longer that a few days, turn the unit off.

Step 8. For electric water heaters an "on/off" timer can produce substantial savings. If the family is gone all day, or if the major use periods are only in the early mornings and early evenings, a timer can turn on the water heater a couple of hours before use, and turn it off when not in use. These timers are powered by the electricity of the system, and are fully adjustable. The cost is soon repaid in savings on the electric bill.

Step 9. Hot water pipes that go through unheated spaces should be fully insulated. Not only does this prevent the pipes from freezing, it also saves energy. Refer to the "Plumbing: Weatherization" section of this manual.

Step 10. Up to 5 percent or more can be saved on energy costs by wrapping the hot water heater with an additional fiberglass "blanket". These are available at most plumbing and hardware stores. Be sure to follow the instructions carefully, especially if the water heater is gas operated.

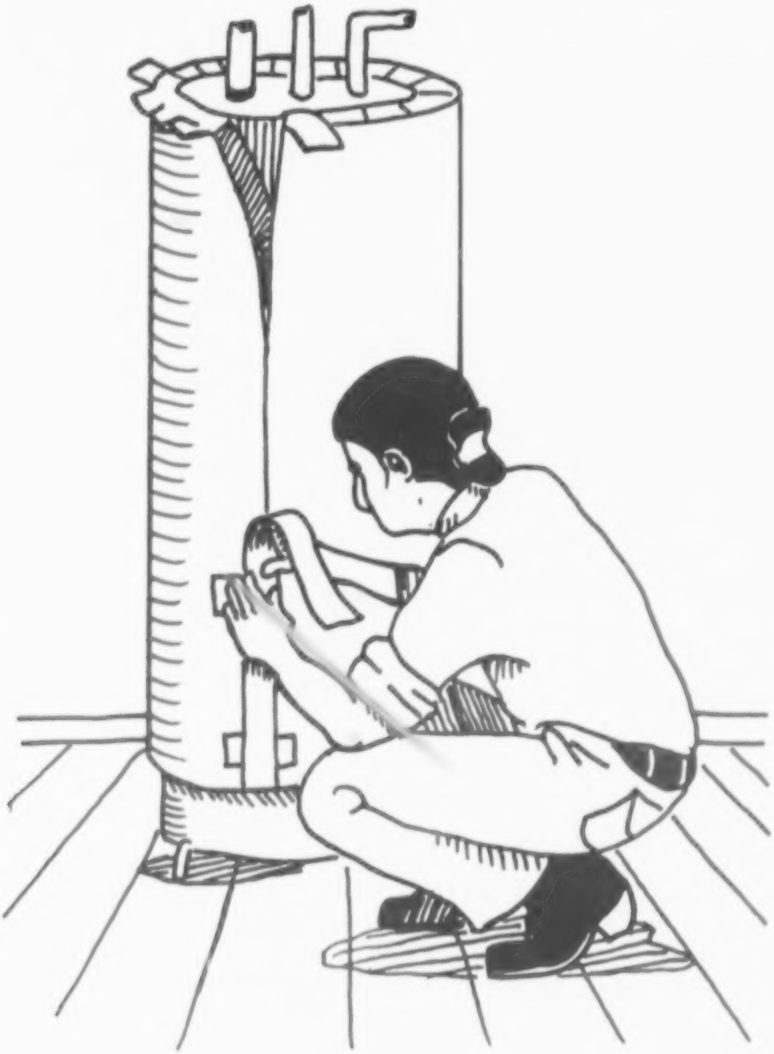

Figure 5.18. Insulate the hot water heater.

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PLUMBING .... Clogged Drains:

PROBLEM: Inside drains become plugged and will not drain.

INFORMATION: When there are items that are not suppose to be put down plumbing fixtures, the fixture may become plugged. Determine what is most often causing the blockage, and avoid putting the item down the fixture.

CAUTION: Flammable and/or combustible liquids like gasoline, motor oil, kerosene or paint thinners should NEVER be put into any drain.

FIXTURE	**COMMON CLOGS**
Kitchen sink.	Grease from frying pans, cooking utensils, or deep fat fryers. Do not rinse the pan scrapings down the drain, the drain will not take melon rinds apricot pits, apple cores, cabbage leaves. or coffee grounds or other food items.
Bathroom sink.	Hair and soap often clog a bathroom sink drain. Shaving is a primary cause of a clogged drain. After shaving, flush drain by running cold water into it. Do not remove the strainer in the bottom of the sink to get the water to drain faster. Doing so will allow objects like earrings, wedding bands, shampoo bottle caps, toothpaste caps, hair pins, razor blades to find their way down the drain.
Bathtub, shower.	Hair, soap and shampoo, bottle caps, parts of toys.
Toilet (water closet)	It is the largest size drain in the house, which means it can get all sorts of things stuck in it. No diapers, or rags, should be flushed. No dirt and dust. Kitchen wastes are better gotten rid of some other way. No sanitary napkins or tampons.
Washing machine.	Extremely soiled items, like garage rags, or overalls, over time, may stop up the drain with greasy dirt.

PROBLEM: A partially clogged or slow draining kitchen sink, lavatory, bathtub, shower or floor drain.

INFORMATION: One method of clearing a partially clogged drain is to use a chemical drain cleaner. Drain cleaners come in two forms; liquid and crystal.

CAUTION: Use chemical drain cleaners only on partially clogged drains. DO NOT use on totally clogged drains. Read the directions carefully.

Liquid drain cleaners are heavier than water and will settle into a partially clogged drain to begin dissolving grease, food, soap and hair that normally clogs drains.

Crystal drain cleaners come in a granular form and begin the drain cleaning chemical process when in contact with water.

CAUTION: These chemicals are POISON. They are caustic and will burn skin. Wear gloves and keep face away from the drain. READ LABELS. Match drain cleaners to clog and type of pipe material. Use acids to dissolve soap and hair. Use alkalis to cut grease. DO NOT MIX CHEMICALS.

CAUTION: When pouring chemicals they will splatter. DO NOT get too close.

TOOLS AND MATERIALS:

Drain cleaner

Old spoon for drain cleaner

Funnel to fit into drain

Rubber gloves

Eye protection

Plastic bucket

THE JOB: Clearing a clogged drain.

CAUTION: Chemical drain cleaners do not work well in toilets due to the shape of the toilet. DO NOT use chemical drain cleaner in the toilet.

Step 1. Put on gloves and eye protection.

Step 2. Remove sink plug or strainer.

Step 3. Dip out as much water as possible.

Step 4. Read chemical drain cleaner instructions carefully, and completely. Follow all of the directions. Observe all precautions.

Step 5. Place the funnel into the drain.

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Step 6. Pour or spoon chemical drain cleaner into the drain, using the right amount.

Step 7. Remove the funnel.

Step 8. Close the cleaner container.

Step 9. Allow the clemicals to bubble for up to one-half hour.

Step 10. If water begins to drain, turn on the faucet and thoroughly flush drain.

Step 11. If drainage improves, but is not fully corrected, repeat the process or refer to the other plumbing sections in this unit.

Step 12. If drain is cleared thoroughly rinse out the entire fixture, wash spoon, funnel and gloves.

CAUTION: Store remaining drain cleaner out of the reach of children.

PROBLEM: Clogged drain.

INFORMATION: The plunger is often called the plumber's friend because it will often clear a totally blocked drain. There are two types of plungers; molded and flat.

The molded plunger is used for the curved surface of the toilet bowls.

The flat plunger is for flat surfaces like sinks, showers, and tubs.

CAUTION: Never use a plunger while using chemical drain cleaners. The action of the plunger may splash chemicals and cause serious harm.

TOOLS AND MATERIALS:

Plunger (flat or molded)

Rubber gloves

Bucket

Rags

Petroleum jelly

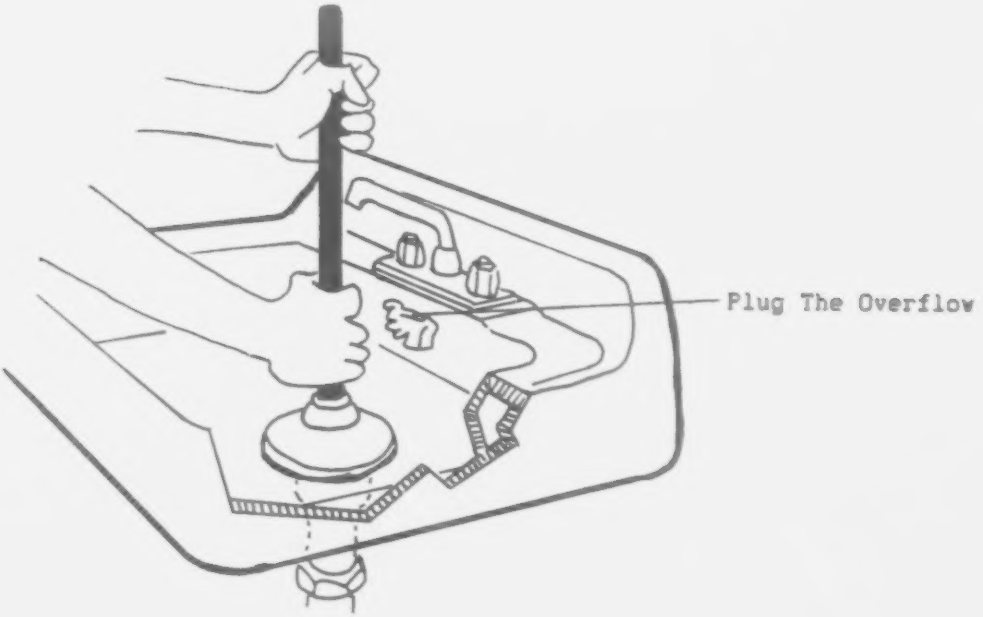

Figure 6.01. Use a plumber's helper to unclog drains.

THE JOB: Unclogging the sink.

Step 1. Remove the stopper or strainer from the drain.

Step 2. Stuff a rag into any fixture overflow.

Step 3. If it is a double kitchen sink, tightly plug the drain not being plunged.

Step 4. Lubricate the plunger base lip with petroleum jelly to help form a tight seal to the sink.

Step 5. Either remove excess water with bucket or fill the sink with two to three inches of water to cover the drain.

Step 6. Place the plunger over the drain and push down and pull up several times quickly and rhythmically.

Step 7. If the rag in the overflow falls out, have someone hold it in place to seal the drain.

Step 8. At end of plunging sequence, quickly pull up on plunger to help pull clog up the drain to start the water moving.

Step 9. Lift plunger out and see if the drain has cleared.

Step 10. Repeat process a few times. Watch for improvement in drain flow. It can take several attempts to clear the blockage.

Step 11. If the drain clears, turn on the faucet and allow water to thoroughly flush the drain. Clean plunger, sink and gloves.

Step 12. Replace any strainers or plugs.

Step 13. Remove the overflow rag.

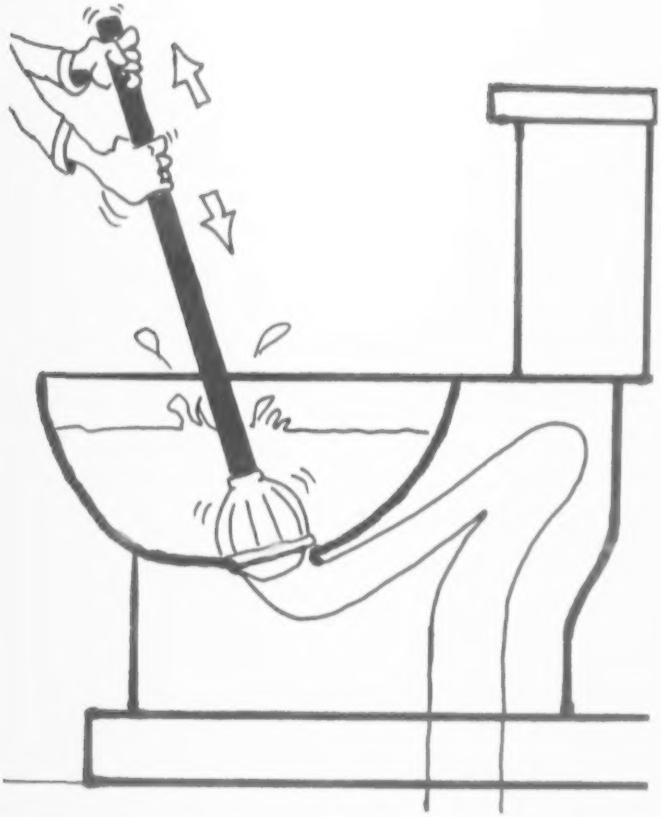

Figure 6.02. Plunging a toilet.

THE JOB: Unclogging the toilet.

Step 1. Use a molded plunger.

Step 2. Apply petroleum jelly to plunger lip.

Step 3. Make sure there is some water in the bowl.

Step 4. Operate the plunger as with the sink.

Step 5. Success will see a drop in water level in the bowl.

Step 6. If this does not work, you will need to use a toilet or closet auger. (See illustration in the section on DRAIN AUGER.)

PROBLEM: A clogged drain that resists clearing after attempts with a plunger and chemical cleaners.

INFORMATION: There are several types of drain augers, also called snakes.

A coiled spring auger in 25' or 50' lengths will have a wire blub on one end and a sliding swivel handle with a thumbscrew lock. This lock is used to rotate the auger after it is inserted into the drain.

A flexible wire auger will also have a wire bulb head. It may have handles on a funnel. One handle holds the funnel and the other handle rotates the funnel to clear the blockage as the wire is moved down the drain. These are less messy because the hand does not come in contact with the dirty auger wire when pulling it out of the drain.

A flat stiff steel tape auger or sewer rod may be 50' long, it has a steel ball to push out the blockage on one end and a handle that slides along the tape on the other end. The handle can also be used as a lever to push the tape into the drain. Often this tape is used in the main drains.

A closet (toilet) auger is a short, coiled steel, wire snake with a bulb to enter the toilet's "S" shaped trap. It has a handle to rotate the wire snake. This auger is used mostly for toilet blockages.

A "snagger", can be made from a coat hanger to remove a blockage from a drain when nothing else is available to remove the blockage.

TOOLS AND MATERIALS:

Desired auger

Gloves

Rags

Plumbers wrenches (to remove the "P" trap if necessary)

Bucket to drain the "P" trap

Screwdrivers, regular and phillips

Spare 1 1/4" or 1 1/2" "P" trap rubber washers

THE JOB: Snaking a clogged drain.

The most effective way to snake loose a clogged drain is to remove the "P" trap under the sink and snake the auger directly into the drain pipe. If removing the trap is a last resort, try putting the auger down through the sink strainer.

CAUTION: It is possible to poke a hole through an old metal "P" trap with the auger, if the "P" trap is worn thin. BE CAREFUL!

Some "P" traps have a nut on the very bottom of the trap. Remove this nut after placing a bucket under it to drain the water. Push the auger into the drain from below the sink.

Use new rubber washers when replacing the "P" trap.

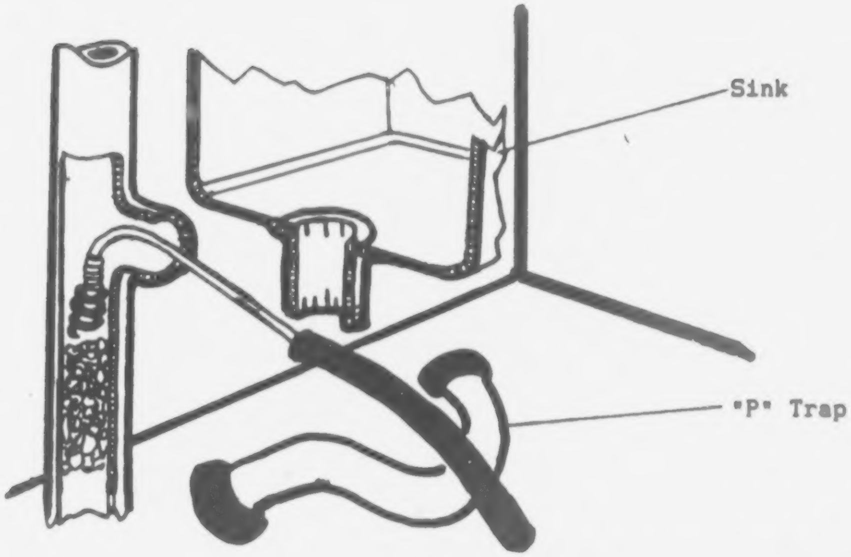

Figure 6.03. Remove the "P" trap to get at a clogged drain.

Step 1. Push the snake into the drain until it stops.

Step 2. Move the handle within 6" of the drain and tighten the handle as necessary. Turn the auger in one direction to chew into the blockage.

Step 3. Pull the snake back and see if the drain begins to clear. Keep pushing and turning snake until drain the begins to clear. This may take quite a long time if blockage is hard.

Step 4. Keep pushing snake into the drain as blockage is cleared. Wash down the drain with water.

Step 5. For bathtubs, sometimes the auger will need to be pushed down the overflow drain line to get to the blockage. Then remove the overflow lever and cover the plate with a screwdriver. Pull out the stopper.

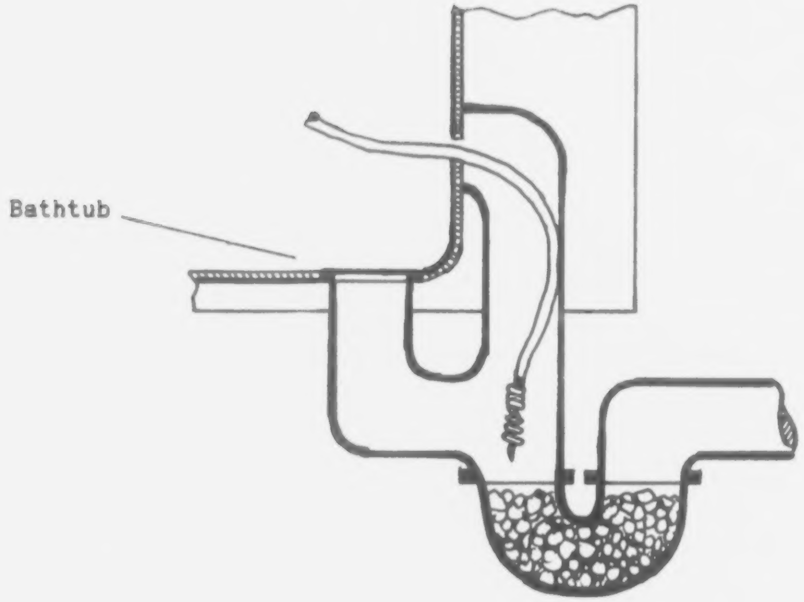

Figure 6.04. Unclogging bathtub from the overflow.

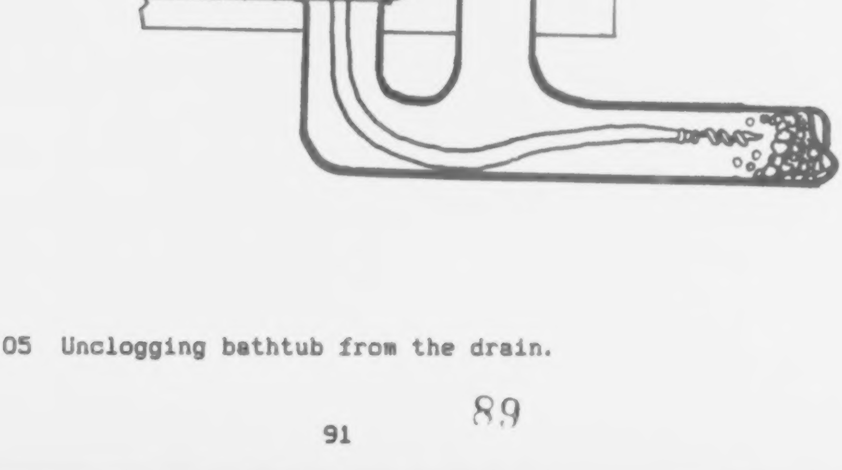

Figure 6.05 Unclogging bathtub from the drain.

Step 6. For toilets, if the plunger has not removed the clog, two tools are left to use before removing the toilet from the floor, and entering the drain from underneath the toilet.

A. A clothes hanger, or "snagger" may be bent to form a hook to access the "S" trap, hook the blockage, and pull it loose.

B. Use a closet auger and rotate the coiled wire into "S" trap to loosen the clog.

NOTE: Sometimes a toothbrush, plastic bottle cap or toy will get wedged in the toilet. The last solution is to remove the toilet. If the toilet is removed, the rubber or wax closet bowl ring needs to be replaced.

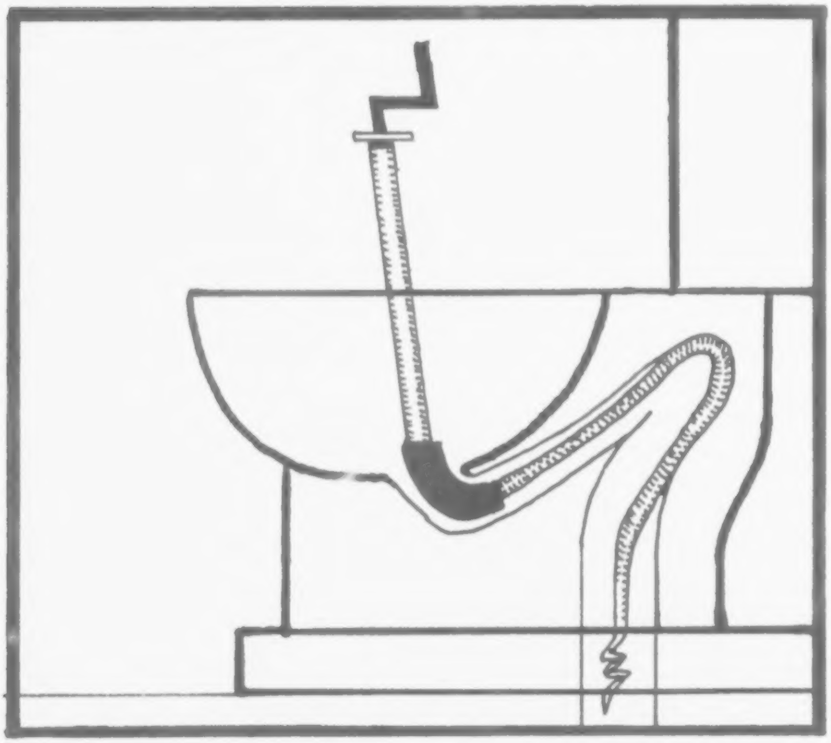

Figure 6.06. Proper use of a closet auger.

PROBLEM: Clogged drain that can NOT be reached from fixtures with auger, or more that one fixture is stopped up.

INFORMATION: The house cleanout or main-drain cleanout allows access into the main drain for removing blockage. The main drain may also be reached by snaking an auger down a large plumbing vent on the roof. The main cleanout is about 2 feet outside the building, where the main drain runs to the septic tank or where the sewer line begins.

CAUTION: Opening the main cleanout accesses raw sewage and germs. It can be extremely messy and unhealthy. Never leave the cleanout plug off while unattended, as sewer lines contain combustible gases. Never leave a garden hose in a sewer line. It could contaminate the water supply and cause sickness.

TOOLS AND MATERIALS:

Large crescent wrench

Rags

Gloves

Auger, garden hose, balloon bag, or sewer rod

Buckets

Mop

Overalls

Flashlight

THE JOB: Unclogging Main Drain.

Step 1. Locate the sewer cleanout plug. Look outside the house for a 3" or 4" black pipe sticking out of the ground about, 2 feet from the house. If not found, go under the house, into the crawl space, and look for the black pipe there.

Step 2. Use a large crescent wrench and loosen the cleanout plug. The plug should have a square on top, used to turn it.

Step 3. Turn the plug slowly, allowing any water to drain into a bucket if possible.

Step 4. With cap removed, insert sewer rod, auger, hose and rags or balloon bag to remove bockage.

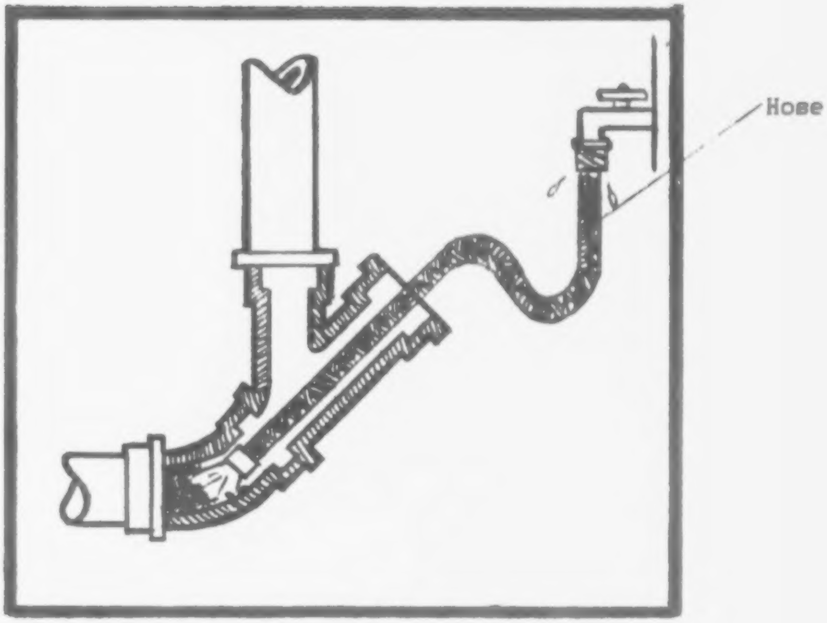

Figure 6.07. Unclogging outside drain with hose.

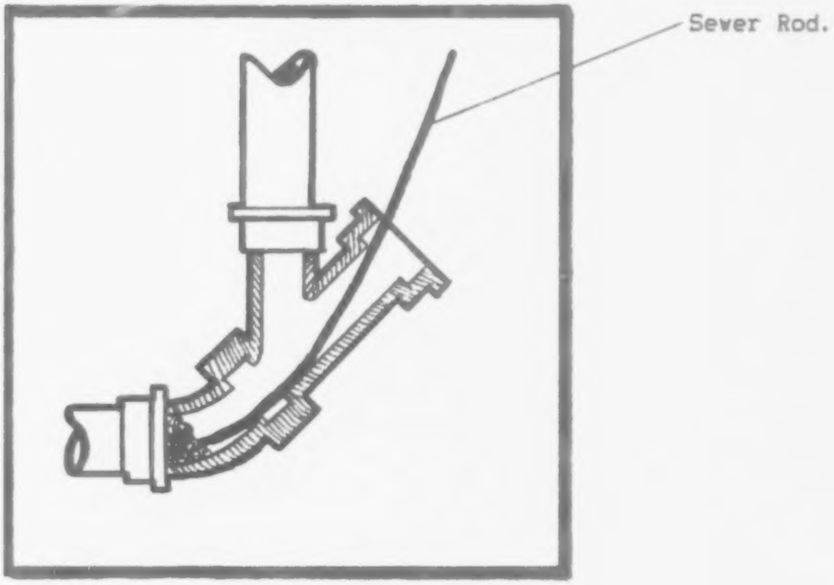

Figure 6.08. Unclogging outside drain with sewer rod.

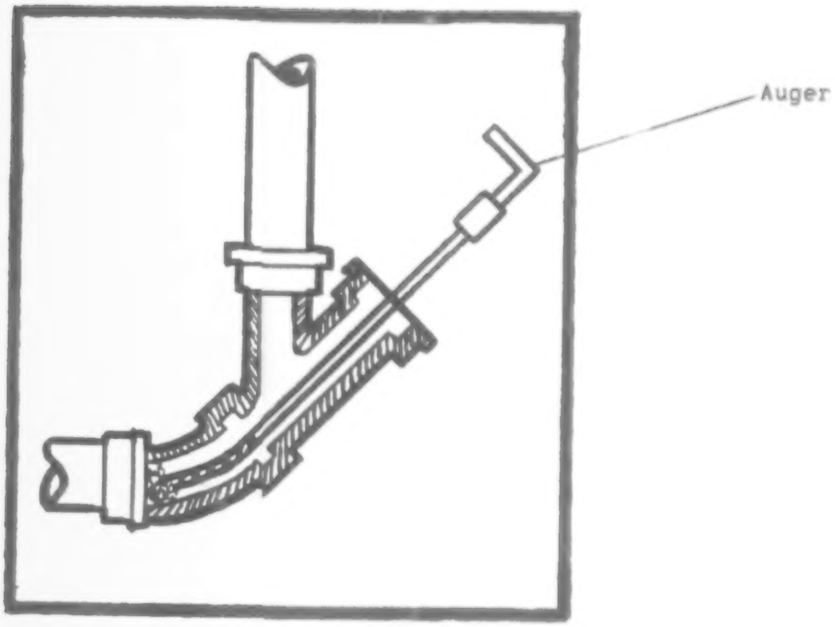

Figure 6.09. Unclogging outside drain with an auger.

Step 5. Make sure auger goes up the drain to the clog. An auger may be snaked in either direction, up or down. If after removing the plug there is water in the drain, then the clog is down. If there is not water, the clog is up in the house.

Step 6. Run a lot of water through the drain after the clog breaks up to wash down all debris.

Step 7. If the clog cannot be cleared or tree roots may have blocked the system, call a plumber who has a power auger with an expandable root cutting auger head to do the job.

Step 8. Close the main drain plug and clean up any debris.

PROBLEM: A faucet drips no matter how tightly it is shut off. This wastes water and makes the water bill higher.

INFORMATION: Identify the type of faucets in the house. They will be one of two basic types:

1. A compression faucet usually has two handles and one spout.
2. A "washerless" faucet usually has a single lever or knob.

There are several types of "washerless" faucets: disc, valve, ball, or cartridge. Be sure to get identical parts for the faucet model. They vary by manufacturer.

Before beginning faucet repairs take, time to prepare properly. Plug the sink so that the little parts do not VANISH down the drain. Line the sink with a towel to prevent chipping or cracking the fixture if a tool is dropped.

CAUTION: Shut off the water supply to the faucet before beginning the repair. Turn off the supply either at the fixture shutoff valves, usually located under the fixture, or turn off the main valve to the house. Then open the faucet to drain the excess water in the line.

TOOLS AND MATERIALS:

12" crescent wrench

Regular screwdriver

Phillips screwdriver

Replacement washer

Allen wrench set

Valve stem packing

Strap wrench

THE JOB: Replacing the washer.

If there are separate hot and cold water handles, the faucet is probably a compression faucet. When this faucet is turned off, a rubber washer seats against the water supply opening to shut off the water flow. If the faucet drips after tightening the valve handle, the rubber washer needs to be replaced. The rubber washer is on the bottom of the valve stem, held there by a screw.

NOTE: Failure to replace a rubber washer when needed could result in a damaged valve seat. The leaking water will cut a grove in the valve seat.

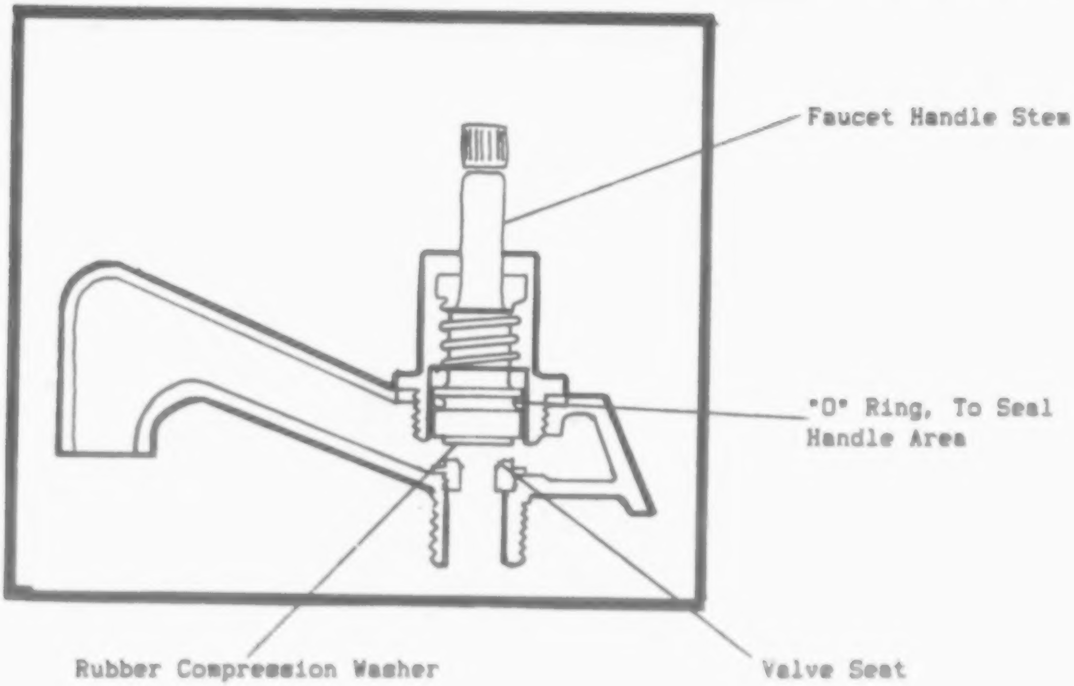
Faucet Handle Stem
"O" Ring, To Seal Handle Area
Rubber Compression Washer
Valve Seat

Figure 6.10. Typical faucet.

Type of faucets in house. Record information.

KITCHEN: Type:____________________________Size:____________________________

BATHROOM: Type:____________________________Size:____________________________

Step 1. To find out which faucet handle is leaking, shut off the fixture supply valves (usually under the sink) one at a time and see which stops the drip. That is the rubber washer that needs to be replaced.

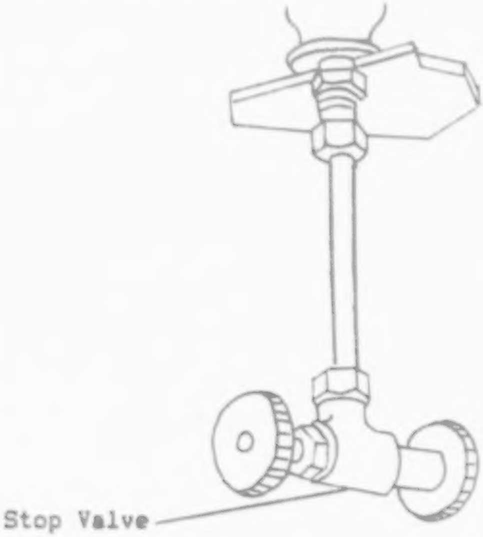

Figure 6.11. Stop valve under the sink.

Step 2. Remove the faucet handle, it will be held to the valve stem by a screw in the top. The cap may have to be pryed off, or there may be an allen type set screw on the side.

Step 3. Use a cresent wrench to remove the packing nut and/or the stem nut and lift out the valve stem.

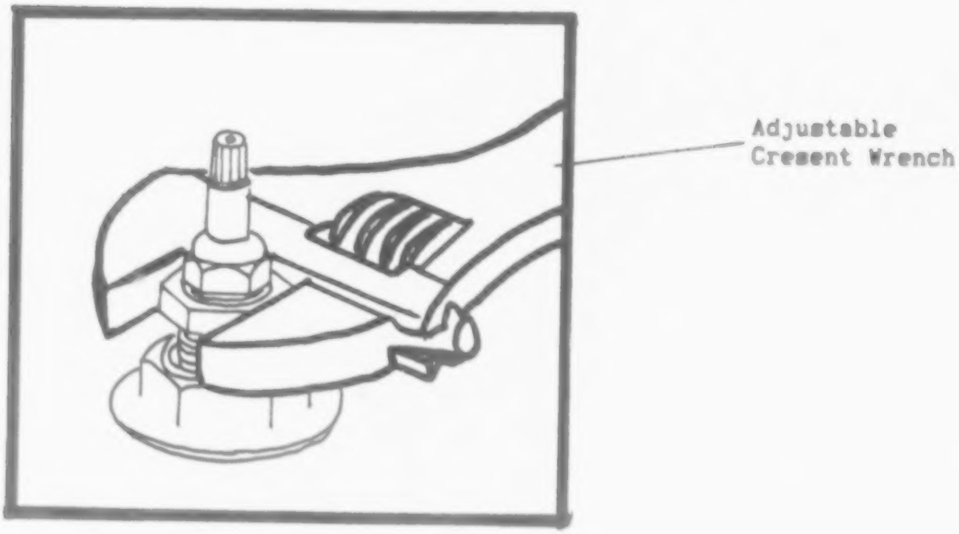
Adjustable
Cresent Wrench

Figure 6.12. Stem nut removal.

Step 4. With the valve stem in hand the problem rubber washer should be seen.

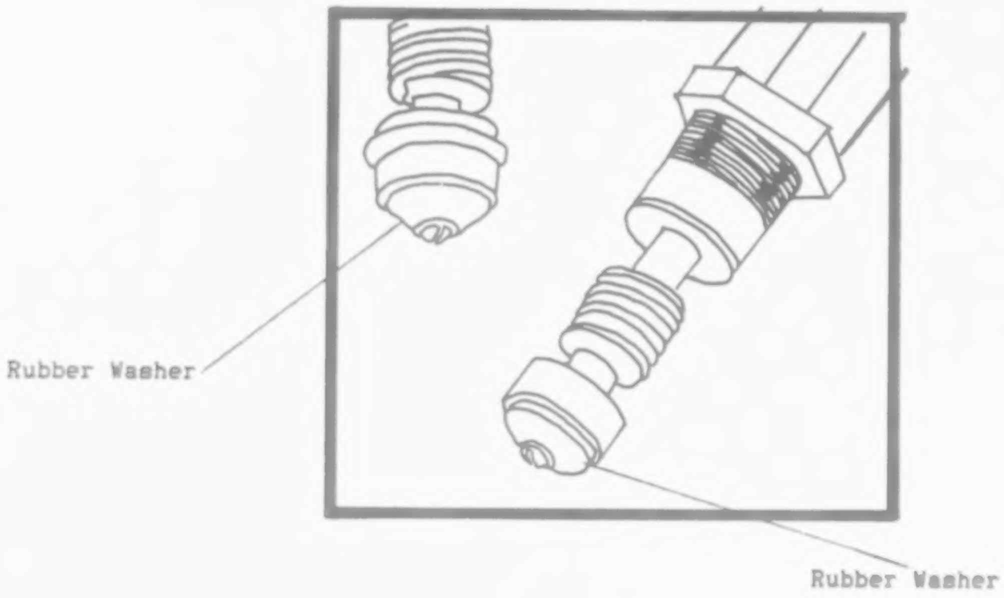
Rubber Washer
Rubber Washer

Figure 6.13. Two types of rubber washers.

Step 5. Unscrew the rubber washer screw and remove the old washer.

NOTE: Do not throw away the old rubber washer without being sure the new washer is the correct one for the job and does not leak.

Step 6. Install the new washer, making sure it fits, and tighten the washer screw. Keep the washer clean and free of dirt or grit.

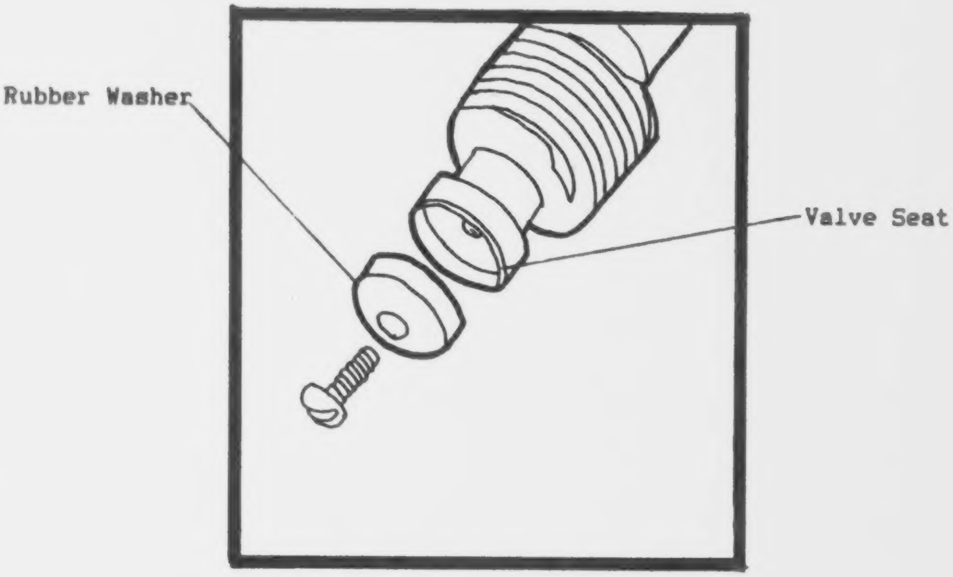

Figure 6.14. Remove and replace the rubber washer.

Step 7. Check the valve stem packing. This packing prevents leaks around the top of the valve stem under the handle. Replace as needed. Check valve seat for pits, scratches, or corrosion.

Step 8. Replace valve stem.

Step 9. Tighten the stem nut to secure the stem in place.

Step 10. Tighten up the packing nut. Check to see that it is tight enough so water does not leak out around the stem, but not so tight that it is hard to turn the valve.

Step 11. Replace the handle, screw and cap.

Step 12. Turn on the water and check for leaks and drips. Tighten as needed.

PROBLEM: The faucet leaks.

INFORMATION: There are several types of "washerless" faucets. They are:

1. Disc faucet
2. Valve faucet
3. Cartridge faucet
4. Ball faucet

It is necessary to discuss the repair of all these types of faucets due to their widespread use.

THE JOB: Repairing disc faucets.

In disc faucets the quantity of water flow and the hot and cold mix are controlled by two discs inside the cartridge of the faucet. Raising the handle, controls water flow by lifting a disc, rotating the handle pivots controls the water temperature.

If the discs wear out, the entire cartridge will need to be replaced.

The most common problem with disc faucets, is the rubber seals at the inlet and outlet, at the bottom of the cartridge.

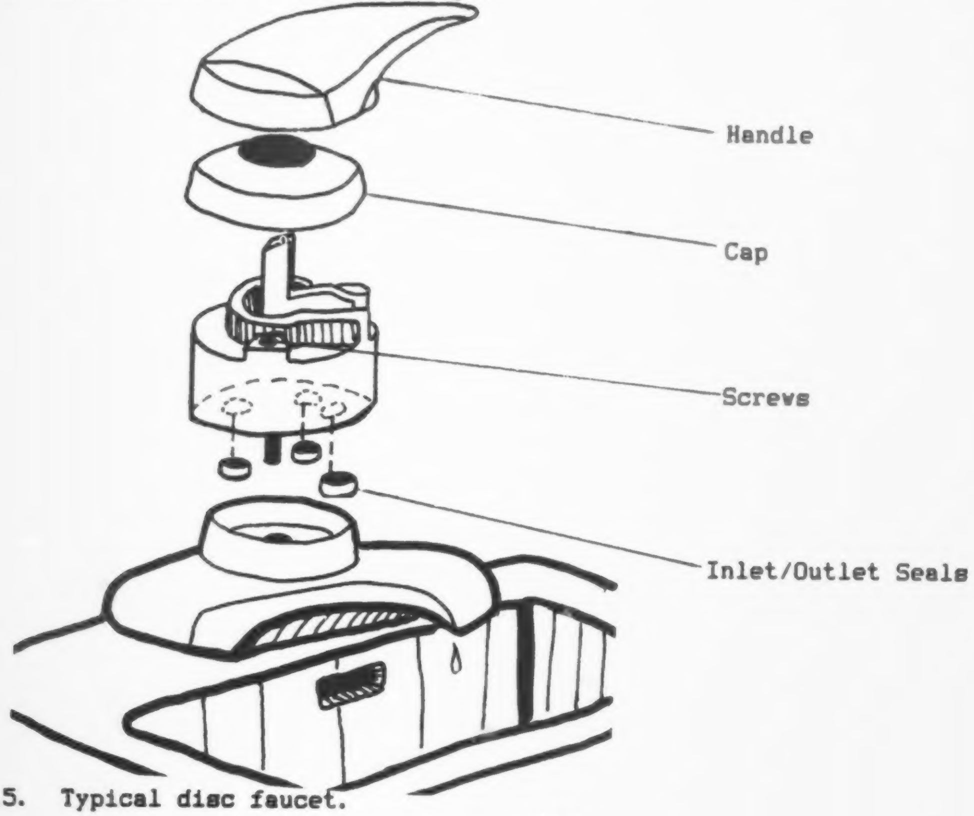

Figure 6.15. Typical disc faucet.

Step 1. Turn off the water valve underneath the sink.

Step 2. Use an allen wrench to unscrew the handle set screw.

Step 3. Lift off the handle and cap.

Step 4. Unscrew cartridge screw.

Step 5. Inspect inlet and outlet rubber seals. Replace if they are worn or damaged. Save the old ones until the correct size is known.

Step 6. Clean off any scale build up.

Step 7. Inspect the cartridge discs and replace the cartridge if they are worn.

Step 8. Carefully put the faucet back together. Line up the seals on the bottom of the cartridge with the holes in the faucet body.

Step 9. Replace cap, handle and set screw.

Step 10. Turn on the water supply to the faucet.

Step 11. Check for leaks.

THE JOB: Repairing valve faucets.

The valve faucet uses a hot and cold valve stem and valve seat assembly, operated by one handle. The lever is moved back and forth to control the amount of water flow and side to side to control the hot/cold mix. Each valve has a strainer that can get clogged with scale, if water flow is low.

The most common problem with valve faucets are spout leaks, loose handles, and sluggish water flow.

SPOUT LEAKS

Step 1. Turn off the water valves under the sink.

Step 2. Use strap wrench and remove spout ring.

Step 3. Replace spout "O" ring.

Step 4. Reassemble spout and check for leaks.

LOOSE HANDLE

Step 1. Use a screwdriver and tighten the screw at the base of the handle.

NOTE: The spout may need to be removed to get to the faucet body. There is an adjusting screw to an internal shaft that may need to be adjusted.

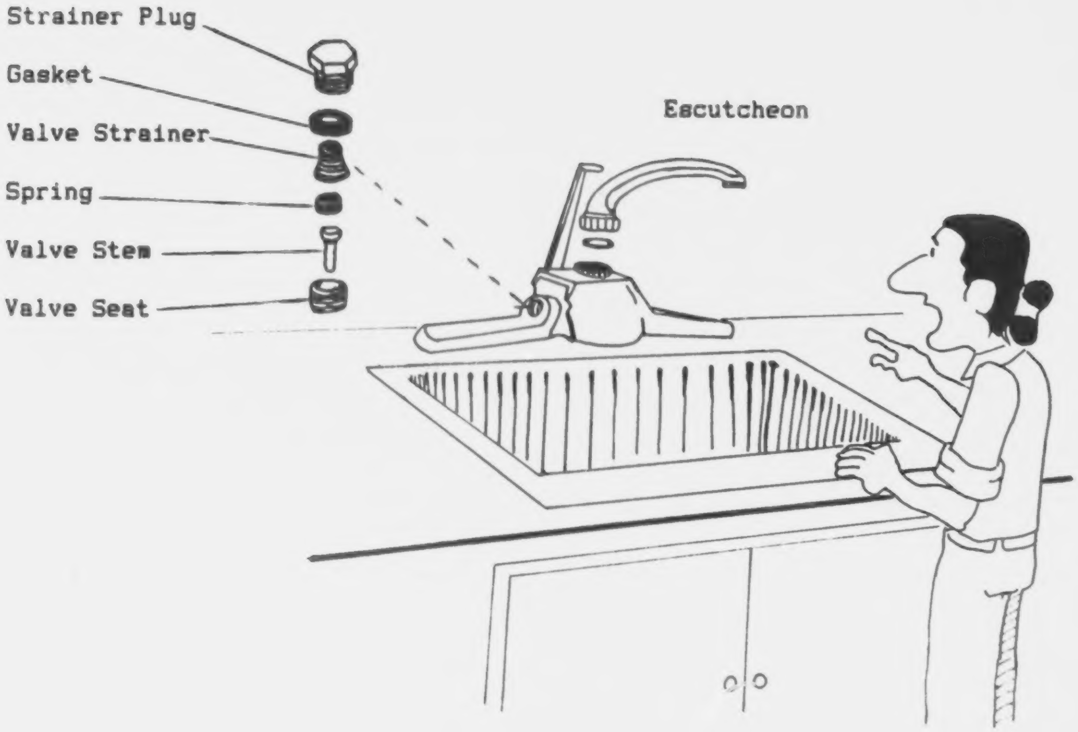
Strainer Plug
Gasket
Valve Strainer
Spring
Valve Stem
Valve Seat
Escutcheon

Figure 6.16. Valve Faucet.

SLUGGISH FLOW OR DRIPS

Step 1. Turn off the water valves under the sink.

Step 2. The valve strainers may need to be cleaned.

Step 3. Remove spout, spout ring and "O" ring.

Step 4. Lift off escutcheon.

Step 5. Use an adjustable wrench and remove strainer plug.

Step 6. Remove gasket, strainer, spring, and valve stem carefully by hand.

Step 7. If valve seat is pitted or scaled, remove it with a valve seat wrench.

Step 8. Clean all parts with steel wool, inspect and replace any worn, faulty parts.

Step 9. Thoroughly rinse strainer removing all scale and blockage.

Step 10. Put it back together, the way it was.

Step 11. Replace strainer plug gasket.

Step 12. Replace escutcheon.

Step 13. Replace spout "O" ring, spout ring and spout.

Step 14. Turn on water supply valve.

Step 15. Check for leaks.

THE JOB: Repairing cartridge faucets.

The cartridge faucet has a series of holes in a stem and cartridge assembly that controls flow and temperature mix. The two biggest problems with this type of faucet are worn "O" rings or a faulty cartridge. When repairing these faucets take the defective cartridge to the hardware store to get an exact replacement. The cartridge varies by brand and model.

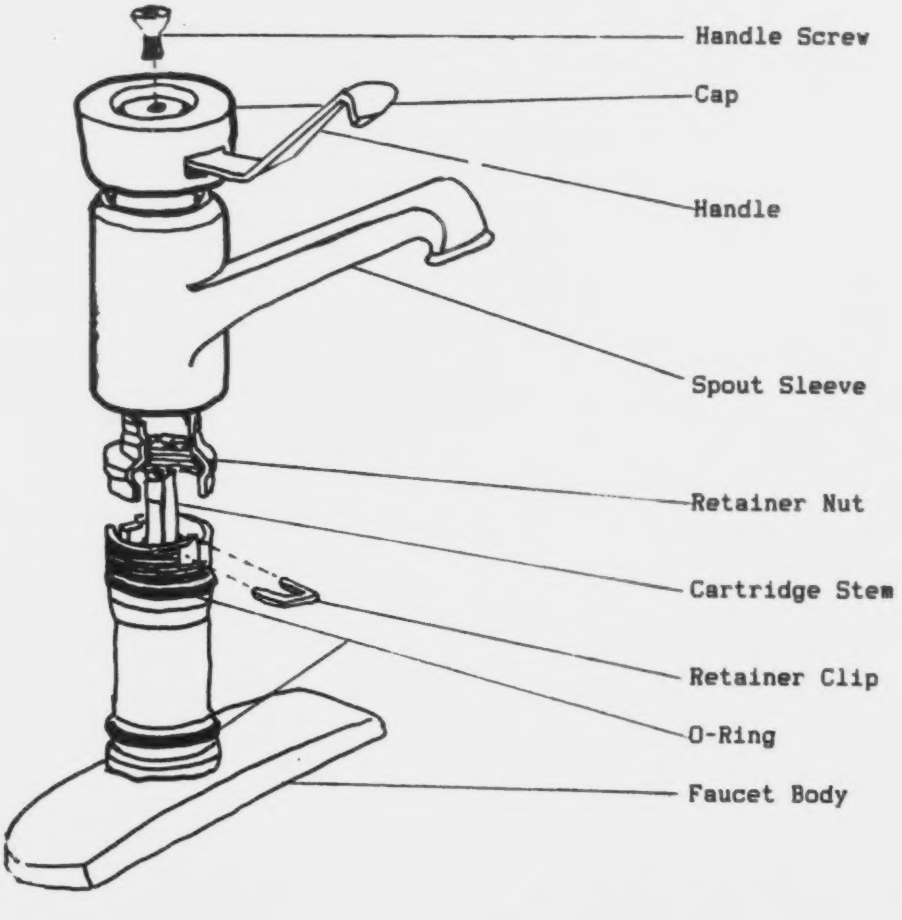
Handle Screw
Cap
Handle
Spout Sleeve
Retainer Nut
Cartridge Stem
Retainer Clip
O-Ring
Faucet Body

Figure 6.17. Cartridge Faucet.

"O" RINGS

Step 1. Turn off the water valves under the sink.

Step 2. Use screwdriver and remove handle screw.

Step 3. Lift off cap and handle.

Step 4. Remove the retainer nut.

Step 5. Wiggle the spout back and forth gently and lift spout sleeve off of the faucet body.

Step 6. Replace the worn "O" rings on the faucet body.

Step 7. Reassemble faucet.

FAULTY CARTRIDGE

Step 1. Follow "O" ring replacement procedures to Step 5 and continue with the following steps.

Step 2. Remove retainer clip from faucet body using screwdriver or needle nose pliers.

Step 3. Grip cartridge stem with pliers and lift it straight up and out of the faucet body.

NOTE: If cartridge has a flat side, face it upward upon reassembly.

Step 4. Replace the bad cartridge with a new one exactly the same.

Step 5. Replace the retainer clip snuggly into the faucet body.

Step 6. Replace the retainer nut.

Step 7. Gently replace the spout sleeve over "O" rings.

Step 8. Replace the handle cap and handle screw.

Step 9. Turn on the fixture water valves.

Step 10. Check for leaks.

THE JOB: Repairing ball faucets.

The ball faucet is quite popular for kitchen sinks, bathroom sinks, and tub/shower faucets. All applications are similar in repair and replacement.

Lifting the handle in the ball faucet controls the water flow. The handle is moved from side to side to control the hot/cold mix. The handle movements line up holes in a ball with a hole to the spout.

The most common problems with ball faucets are leaks under the handle, dripping spout, and sleeve leaks.

LEAKS UNDER THE HANDLE

Step 1. Leave the water ON.

Step 2. Lift off the handle with an allen wrench.

Step 3. Use a screwdriver to tighten the adjusting ring by gently tapping screwdriver inserted in the notch in the adjusting rings.

Step 4. Check to see if the leak has stopped.

Step 5. Replace the handle.

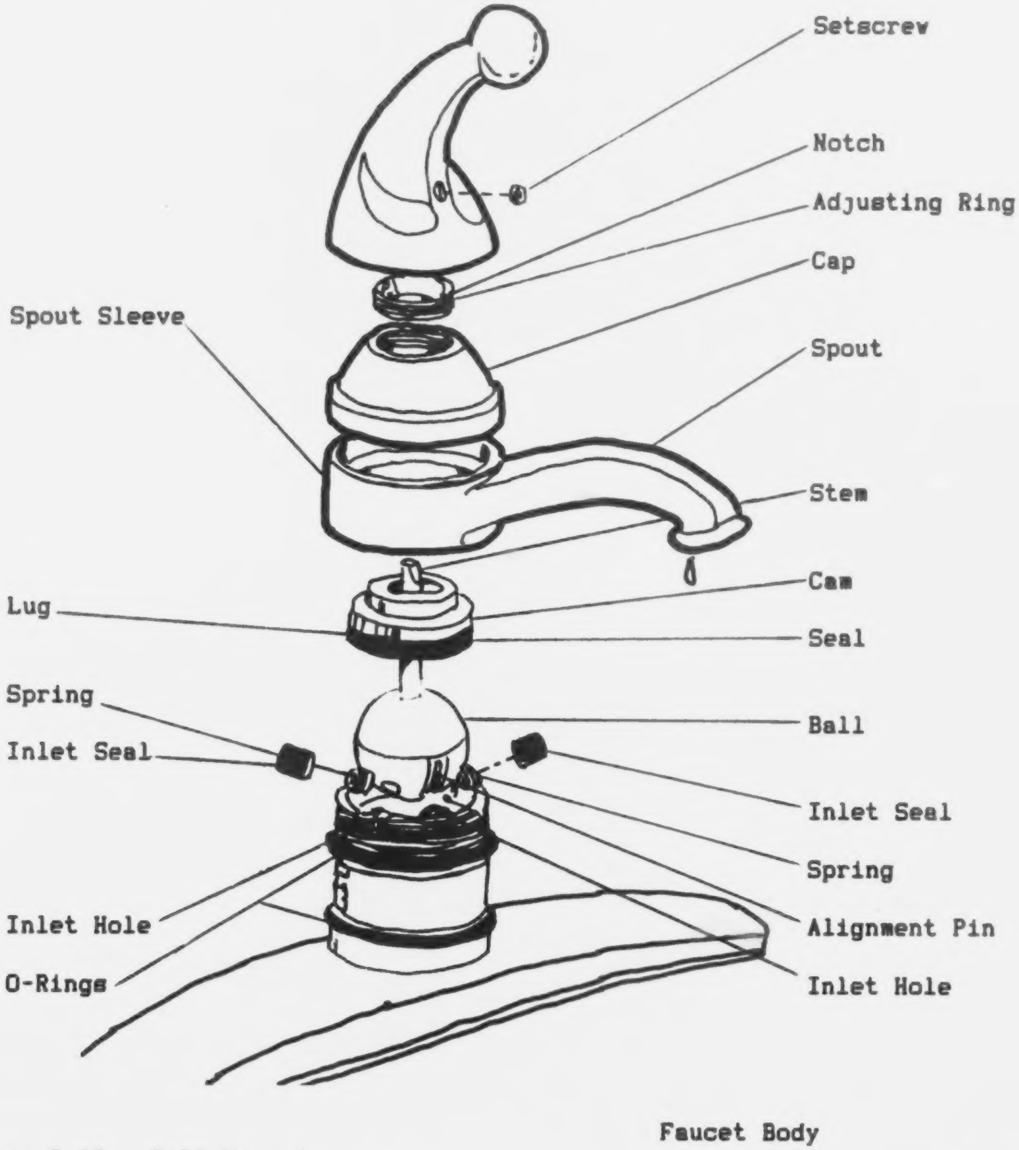
Setscrew
Notch
Adjusting Ring
Cap
Spout Sleeve
Spout
Stem
Cam
Lug
Seal
Spring
Ball
Inlet Seal
Inlet Seal
Spring
Alignment Pin
Inlet Hole
Inlet Hole
O-Rings
Inlet Hole
Faucet Body

Figure 6.18. Ball Faucet.

DRIPPING SPOUT AND SPOUT SLEEVE LEAKS

Step 1. Turn off the water valves.

Step 2. Remove the handle as in the above steps.

Step 3. Use the strap wrench and remove the cap.

Step 4. Carefully lift out the ball, cam, and cam seal by lifting on the stem.

NOTE: The inlet seals and springs may come out with the ball. Do not loose them.

Step 5. Remove the spout sleeve by lifting and wiggling gently.

Step 6. Replace the worn faucet body "O" rings.

Step 7. Replace the old faucet ball, if worn.

Step 8. To replace faucet ball, match the alignment pin in the faucet body with the slot in the ball.

Step 9. Carefully lift inlet seals and springs from a faucet body with the needle nose pliers.

Step 10. Use steel wool and gently remove any scale in the faucet body.

Step 11. Replace inlet seals and springs if worn.

Step 12. If cam and cam seal are worn, replace them at this time.

Step 13. Install spout sleeve over the new faucet body "O" rings.

Step 14. Screw on the cap and tighten the adjusting rings.

Step 15. Turn on the water valves.

Step 16. Check for leaks.

Step 17. Replace the handle.

Step 18. Tighten the set screw.

Step 19. Clean up.

PROBLEM: The kitchen or bathroom faucet needs to be replaced.

INFORMATION: "Washerless" single-handle faucets are very popular. They are economical, convenient and help save water compared to the older two-handle "washer" faucets. The washerless faucets include the disc, valve, ball or cartridge type. They may be made of inexpensive plastic with a chrome finish, or steel, or solid brass. The price goes up with the type of the material used and the "style". The new faucet must fit the same holes in the sink. DO NOT cut new holes or enlarge the holes in a porcelain sink.

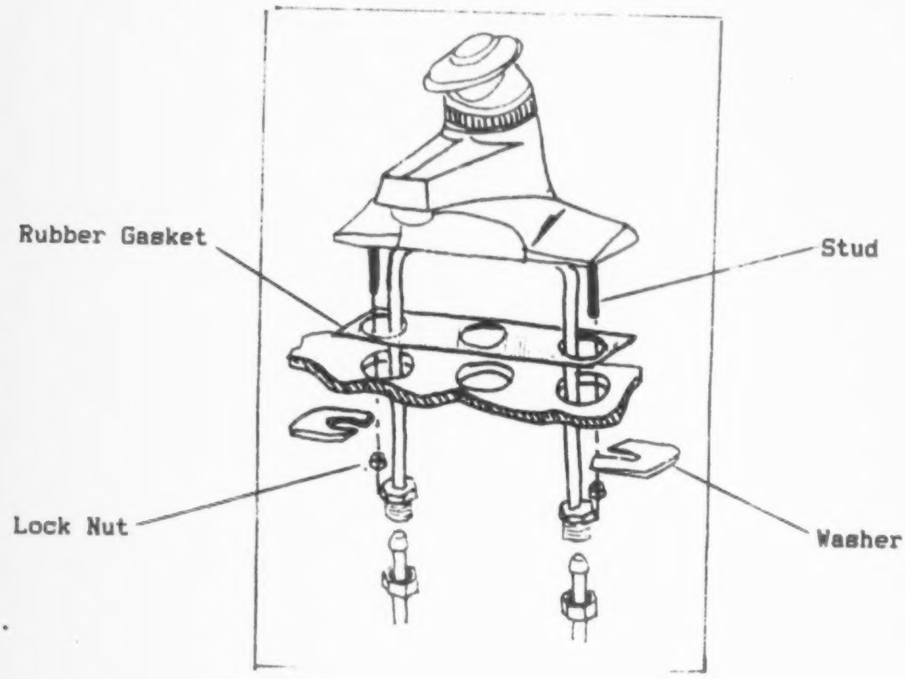

Figure 6.19. Typical washerless faucet.

Look under the sink for the holes where the old faucet is mounted. Measure the distance from center to center of the holes. Use these measurements when buying the new faucet.

While under the sink, check the water supply line fittings. Measure them. See what type of fittings they are and their size. It may be better to turn off the water supply to the fixture, remove the SUPPLY LINE and take it to the store when buying a new faucet. This will insure getting the right size and type of fittings.

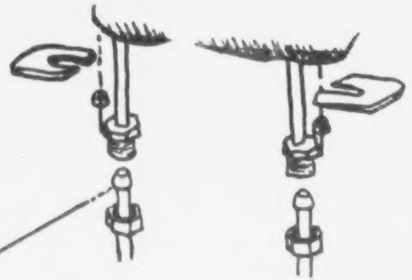
Compression Fitting
Water Line To Fixture For
Cold Or Hot Water Supply

Figure 6.20. Match the water supply lines with the faucet.

TOOLS AND MATERIALS:

New faucet

Necessary fittings

Basin wrench (if necessary)

2 crescent wrenches, 10" and 12"

Pipe joint compound or tape

Regular and phillips screwdrivers

Any other tools recommended by the faucet manufacturer

Sharp knife or small pocket knife

THE JOB: Removing and replacing the old faucet.

Step 1. Shut off the hot and cold water supplies to the faucet at the fixture shut-off valves. Look under the sink where the pipes stick out of the wall. Turn the valves clockwise.

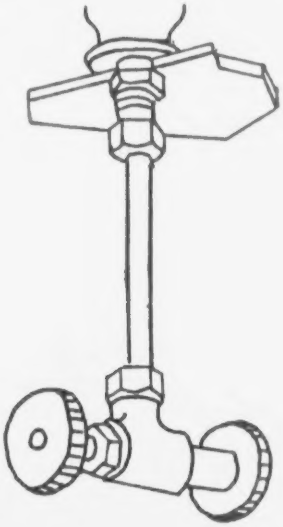

Figure 6.21. Fixture stop or water valve.

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Step 2. Open faucet handles.

Step 3. Read faucet maker's instructions and pictures that come with the faucet.

Step 4. Use the wrenches to carefully disconnect the nuts under the sink where the faucet inlet lines hang below the sink. One nut may need to be held in place while the other nut is turned.

CAUTION: When loosening nuts, do not allow the supply lines to twist or turn. Damage to the lines could result. The lines will be reused.

Step 5. At the underside of the sink there are two mounting bolts that hold the faucet tightly to the sink. Loosen these nuts and remove them from the faucet.

Step 6. Lift out the old faucet. Cut around the base of the faucet on the top of the sink to break the caulking seal if any is present. An old table knife will work.

Step 7. Clean and remove any old caulking on the sink to allow the new faucet to set flat.

Step 8. Place the new rubber gasket on the sink top and align the holes.

Step 9. Place the new faucet into the sink holes from the top side of the sink. Carefully place the faucet on top of the rubber gasket. Make sure it is flat and the water lines are not bent or kinked, which will stop the flow of water.

Step 10. From under the sink, slide the retainer washers over the studs that stick out from the bottom of the faucet.

Step 11. Tighten nuts onto the stud making sure the mounting washer securely clamps the faucet to the sink. Tighten these nuts evenly. DO NOT over tighten them.

Step 12. Reconnect the water supply lines to the faucet. Make sure the correct one is on each side. Use pipe joint compound on the male threads to get a tight fit and no leaks.

Step 13. Turn on the water. Check for leaks.

Step 14. If there are no leaks, turn on the faucet and allow water to run for a minute or more to flush out any dirt or air in the lines.

INFORMATION: Insulating the pipes and other parts of the plumbing system from freezing, saves energy costs. It also saves the cost of replacing or repairing pipes and fixtures that may break when frozen, and the damage they may cause. Pipes, faucets, or fixtures, that are not within the heated areas of the home need protection against freezing and heat loss.

Hot water systems need insulation year round to prevent the water from loosing heat before reaching the faucet. Cold water systems need to be insulated in colder climates to prevent freezing in winter and excessive warming in hot weather.

Faucets outside the house, known as hose bibs, should be the freeze-proof, self-draining type. This design of faucet shuts the water off with a valve located inside the home's walls, where it is warm enough to prevent freezing. The water left in the faucet will drain out and prevent freezing. If outside faucets are freezing, replace them with "freeze-proof" style or heavily insulate them. Check with a local plumbing supplier for the best products and techniques available.

NOTE: **Do not leave a hose connected to a freeze-proof hose bib during the winter months. The faucet will not drain. This will cause the water to freeze and expand, which can break the pipe inside the house.**

INSPECTION PROCEDURES

1. Get the flashlight and crawl underneath the house. Check to see that all exposed water lines are insulated.

2. If there are pipes that are not insulated, buy slip-over foam insulation to cover them. Although somewhat expensive, the 3/4" to 1" foam will prevent heat loss and freezing when properly sealed with tape. They can be installed with a knife and some duct tape.

CAUTION: **Some areas have poisonous insects and/or snakes, be careful when crawling under the house. Cold weather is the safest time to do so.**

3. Some houses have plumbing water lines in the attic. If this is the case, use a flashlight to check out the insulation and see if the pipes are exposed. Watch out for spiders and wasps in their seasons.

COMMON PROBLEMS, CAUSES AND SOLUTIONS

PROBLEMS	POSSIBLE CAUSES	SOLUTIONS
No hot water, although cold water is turned on to the water heater.	Water supply line to the hot water heater is frozen.	Turn off the water heater. Unwrap the pipe. Apply heat with a propane torch by starting at the outside edge of the house. DO NOT put too much heat on ONE spot or the solder in the copper pipes might melt.
No hot OR cold water at all.	Supply lines are frozen.	Hopefully they were buried deep enough, according to building code, not to freeze in the ground. Direct attention to any exposed areas where the pipes come out of the ground and run into unheated spaces under or above the house. Repeat the steps in the above solution.
No cold water, hot water is okay.	Frozen pipe after the junction which splits the water supply system into "hot" and "cold" water.	Find the point of the split, which is usually under the hot water tank, and concentrate thawing efforts between the split and the point at which the cold water lines enter the house.

CAUTION: When using an open flame, such as a torch, keep the flame away from ALL COMBUSTABLE MATERIALS.

BURST PIPES

If freezing weather or other problems have caused a leak in the water lines, corrective action must be immediate. There are several steps to take:

Step 1. If the water is hooked into a community or municipal water supply system, shut off the water to the house at or near the water meter. If the water is from a pumped system, shut off the pump.

Step 2. When the water to the house is shut off, the electric or gas to the hot water heater must be shut off to prevent damage.

Step 3. Temporary repair to a water line with a hole or crack can be done with a small section of rubber from a tire or inner tube. Fasten the pipe with rubber hose clamps, available from an automotive supply store.

Step 4. Replace the damaged pipe section as soon as possible.

PROBLEM: Water in the toilet runs all the time.

INFORMATION: Refer to the drawing below throughout all the "Toilet" sections of this manual.

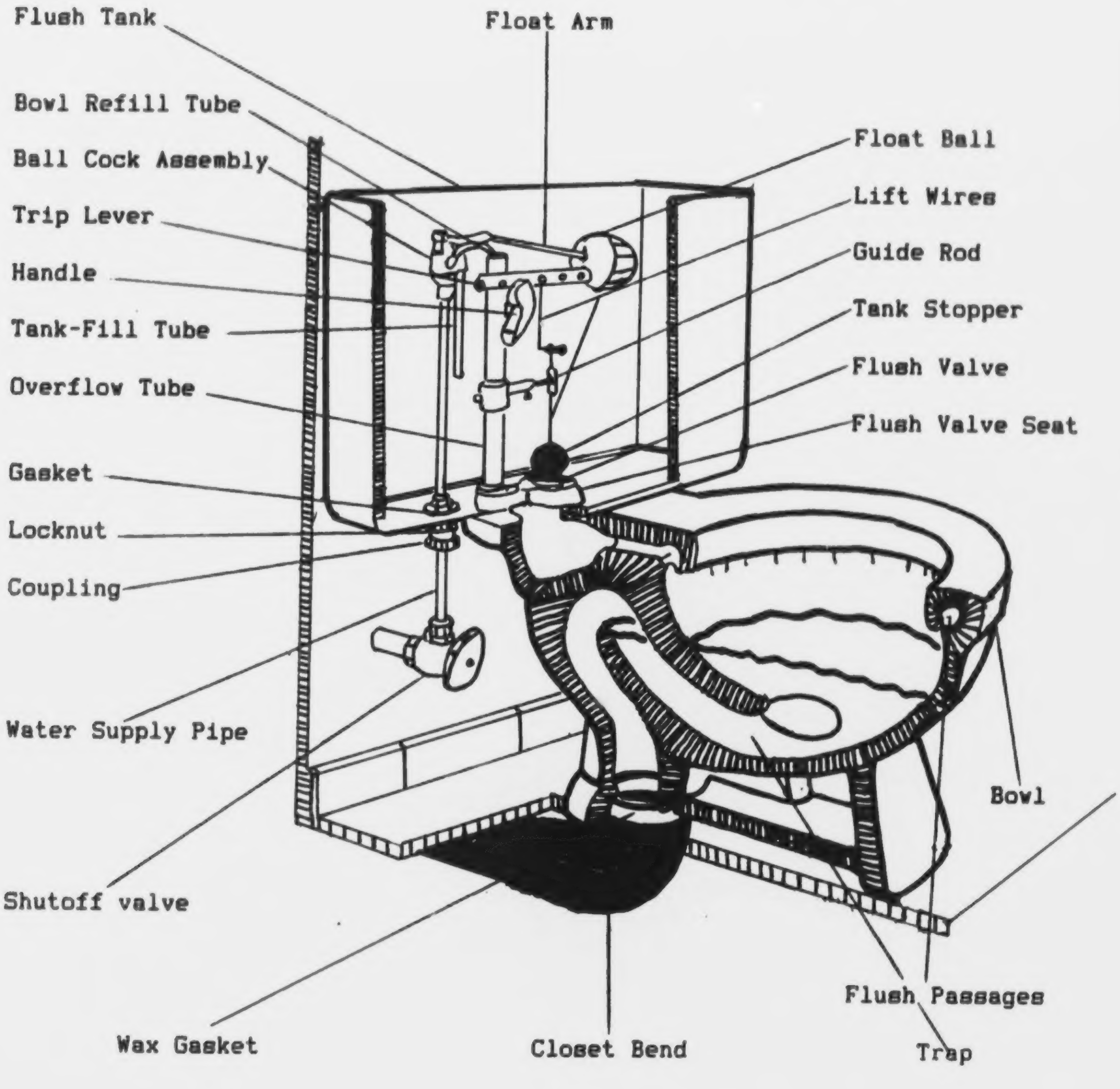
Flush Tank
Bowl Refill Tube
Ball Cock Assembly
Trip Lever
Handle
Tank-Fill Tube
Overflow Tube
Gasket
Locknut
Coupling
Water Supply Pipe
Shutoff valve
Wax Gasket
Float Arm
Float Ball
Lift Wires
Guide Rod
Tank Stopper
Flush Valve
Flush Valve Seat
Bowl
Closet Bend
Flush Passages
Trap

Figure 6.22. The parts of a toilet.

Look for the float ball and float arm at the top center and right of the drawing. This is one of the most common problems with "running" toilets and the easiest to fix.

As the float ball floats on the top of the flush tank water, it opens or shuts the water supply inlet to the flush tank. This controls the water level in the tank at the ball cock assembly.

After the toilet is flushed, the flush tank stopper valve reseats and stops the flow of water from the flush tank, after the toilet is flushed, the water level is at its lowest point. The float ball is also at its lowest point and allows water flow to refill the tank for the next flush. As the water fills the tank the float ball floats up to the top. There should be enough water in the tank for the next flush as the float arm shuts off the water with the ball cock assembly.

TOOLS AND MATERIALS:

Pliers

Towel

THE JOB: Repairing float.

Step 1. If the float arm and float ball do not completely stop the water supply, a simple adjustment of the float arm may be needed. First, look at the float ball and make sure it is not rubbing against the inside of the flush tank. If it is, bend the float arm to prevent the rubbing.

Step 2. If the float still does not shut off the water supply, bend the float arm to put the flat ball farther down into the flush tank. If the water is still running, some parts will need to replaced on the ball cock assembly itself. See section, "Toilet: Worn Flush Ball Linkage.

PROBLEM: Running toilet, with water always running into the bowl.

INFORMATION: If the toilet is always flushing a bit of water, it may have a crooked stopper valve. The stopper valve allows water to flow from the flush tank to the toilet bowl when the handle is pressed. This valve floats back onto the flushing valve seat as the water level in the tank goes down. The stopper valve is guided down onto the valve seat by a guide arm attached to the overflow tube. The lift, or linkage wire that is in the top of the stopper valve is also guided by the guide arm.

The guides are usually attached to the overflow tube by a thumb screw. Usually the problem is a loose thumb screw which causes the stopper valve not to seat properly. If the thumb screw is not loose the lift wire may be worn or dirty, and be hanging up on the guide. This causes the stopper valve not to close correctly on the flush tank valve seat.

TOOLS AND MATERIALS:

Slip joint pliers

Needle nose pliers

Replacement lift wires (old coat hangers work)

Towel

THE JOB: Repairing linkage, or lift wire adjustment.

Step 1. With the water supply turned on and the toilet "running", lift the flush tank lid off the tank. Set it down carefully because porcelain is breakable.

Step 2. Look into the tank and find the flush valve stopper. If it hanging up and not properly seated in the valve seat, find the lift wire, which is coming out of the top of the valve stopper. If it is bent, worn out and hung up in the guide rod collar, an adjustment is needed.

Step 3. Check the tightness of the guide rod thumbscrews. If the guide rod needs to be moved, loosen the thumb screws and straighten the tank stopper so it properly seats in the valve seat. Slip joint pliers may be useful to loosen a stubborn thumb screw.

Step 4. Did the water flowing into the bowl stop? If it has not stopped, see the section "Toilet: Worn Flush Ball Linkage."

Step 5. Look at the lift wires and see if they need to be replaced. Form new lift wires with your needle nose pliers or use replacement lift wires bought at the local hardware store.

Step 6. Line up the guide arm and collar so they are centered over the valve seat. Attach wires at the proper height to the overflow tube to guide the valve stopper and allow it to fully seat in the valve seat.

Step 7. The water should have stopped running. Replace the flush tank lid.

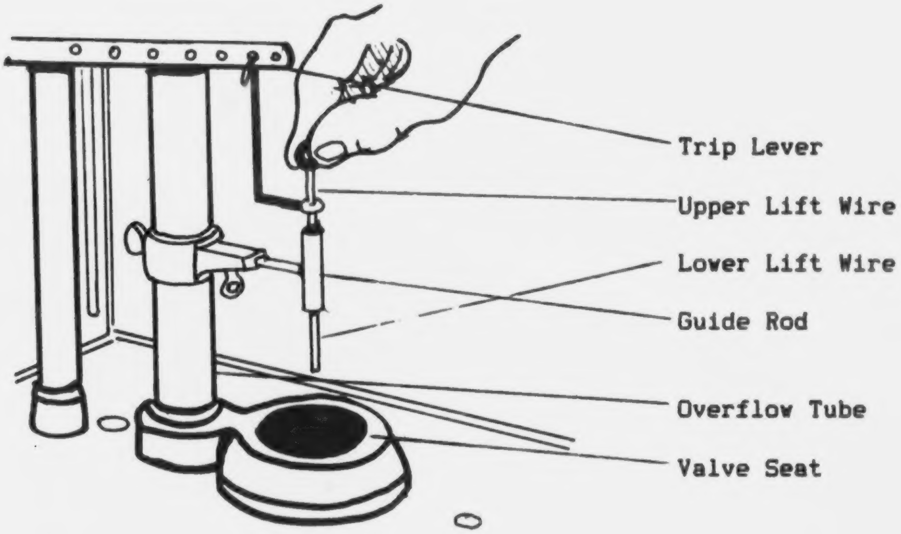
Trip Lever
Upper Lift Wire
Lower Lift Wire
Guide Rod
Overflow Tube
Valve Seat
Thumbscrew

Figure 6.23. Aligning of the toilet tank stopper mechanism.

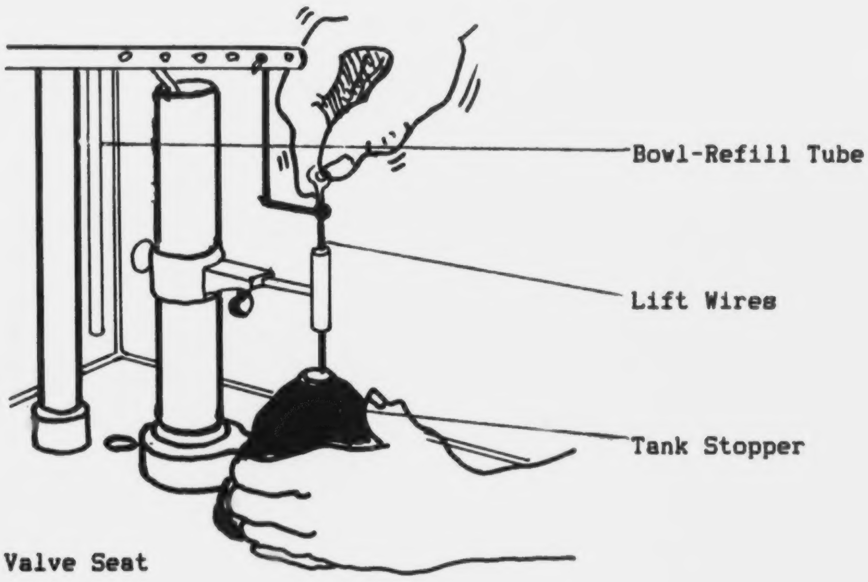
Bowl-Refill Tube
Lift Wires
Tank Stopper
Valve Seat
Overflow Tube

Figure 6.24. Aligning of the toilet tank stopper.

PROBLEM: A "running" toilet that will not shut off.

INFORMATION: A "running" toilet may be the sign of a faulty flush valve assembly; worn, corroded or crooked flush valve.

If a careful examination of the toilet operation shows that the flush tank stopper is not stopping the flow of water from the flush tank to the toilet bowl, look at the following things:

1. The flush tank stopper guide rod, for proper alignment. Discussed in another section in this manual.

2. The lift wires and/or chain assembly. Discussed in another section in this manual.

3. The valve seat of the flush tank stopper may be pitted, scaled up, scratched, worn out or corroded.

Check each of the above mentioned parts for a smooth operation, linkage hang ups and proper valve seating.

TOOLS AND MATERIALS:

Pipe or "monkey" wrench

Channel lock pliers

Adjustable wrenches 10" and 12"

Steel wool

Pipe joint compound

Needle nose pliers

Bucket

Rags

Screwdrivers, regular and phillips

Flush tank stopper valve assembly

THE JOB: Repairing the flush ball linkage.

Step 1. Turn off the water to the toilet. This is done at the fixture valve stop at the water supply line outside the toilet.

Step 2. Flush toilet to clean out flush tank.

Step 3. First, try adjusting the guide rod assembly to the flush tank stopper valve. Loosen the thumbscrews on the overflow tube. Move the valve so that it will line up directly over the top of the center of the valve seat.

Step 4. If the valve seat is uneven and water is leaking passed the stopper, lift up the stopper. Gently clean the valve seat with steel wool to remove any irregularities on the valve seat surface. Replace the valve stopper and check for the proper seat.

Step 5. Check the overflow tube for cracks. If cracked, it will need to be replaced or fixed with caulking sealant until replacement parts are available.

Step 6. If the toilet still runs, replace the flush valve assembly. To do so, disconnect the water supply inlet at the bottom of the flush tank. See the section in this manual.

Step 7. For a bowl mounted flush tank use an adjustable wrench and screwdriver to loosen the two screws that hold the flush tank to the toilet bowl assembly. This is done from the under side of the flush tank. For a wall mounted flush tank, use a pipe or monkey wrench and loosen pipe coupling nuts on the bottom of the flush tank and on the back of the toilet bowl. Remove the connecting pipe.

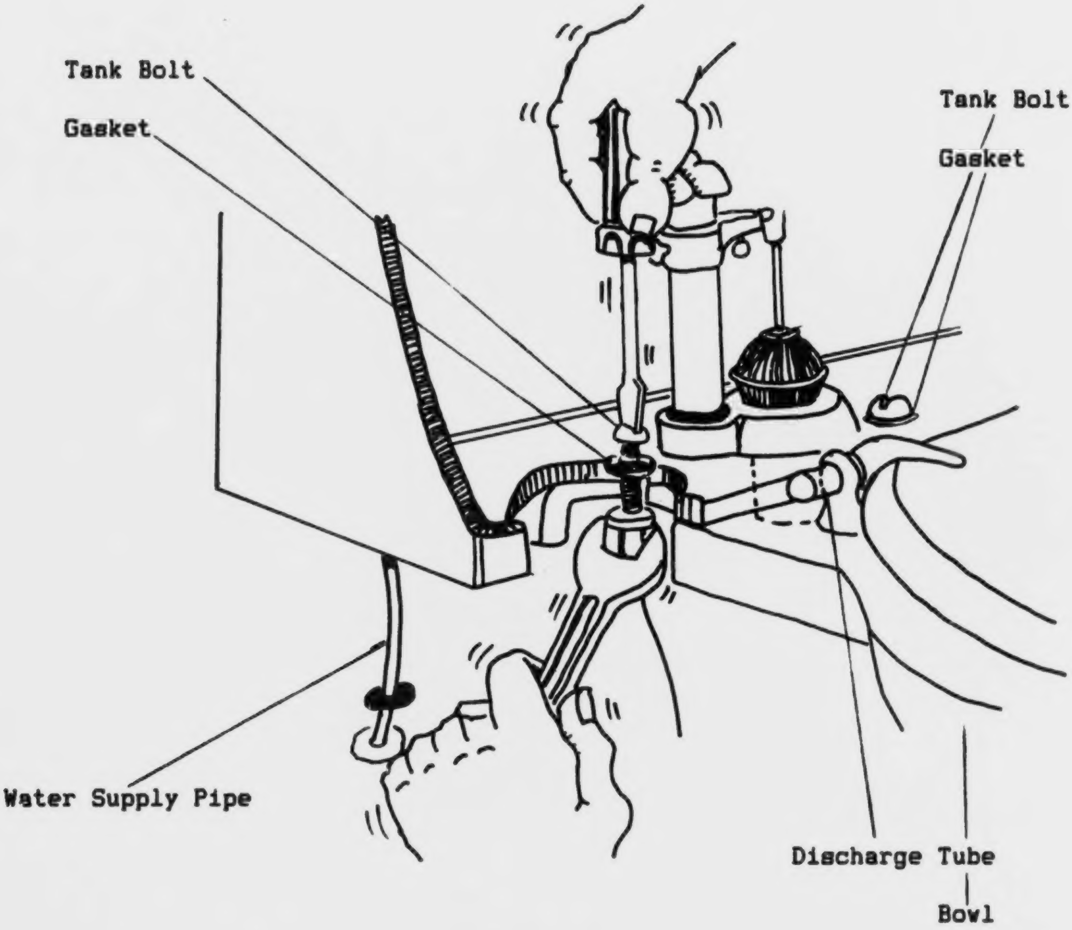

Figure 6.25. Repairing the flush ball linkage.

Step 8. Unscrew the locknut holding the overflow tube and discharge tube (valve seat) on the bottom of the flush tank.

Step 9. Clean up the hole at the bottom of the flush tank with steel wool.

Step 10. Assemble the gasket, flush valve assembly, locknut and conical gasket onto the flush tank bottom.

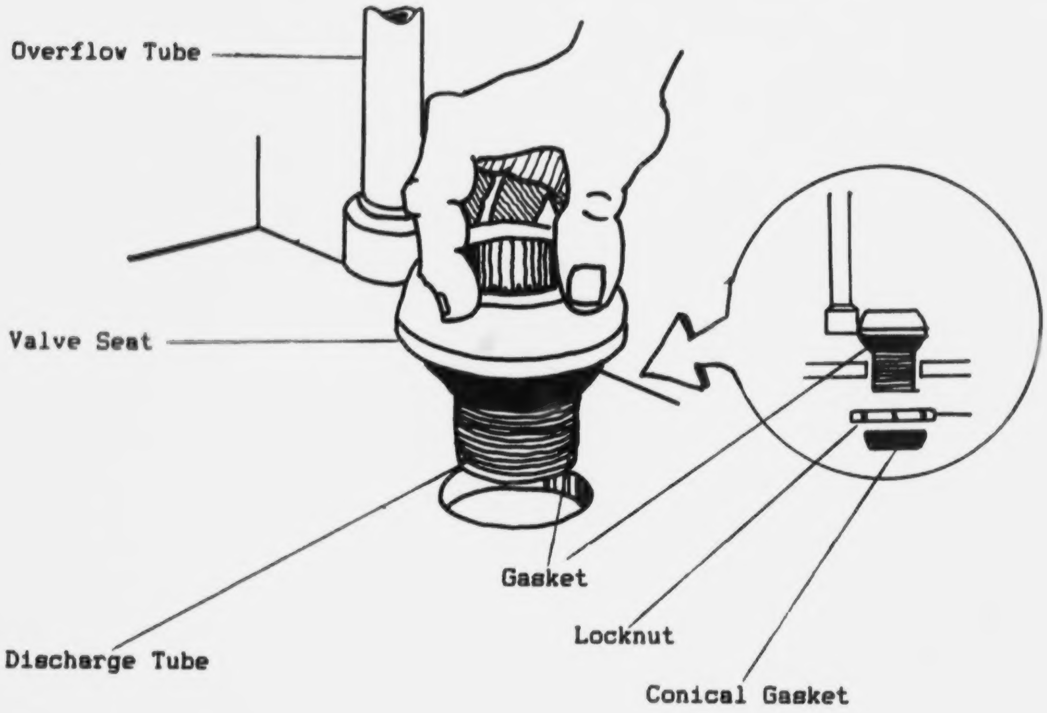

Figure 6.27. Installing new flush tank valve seat assembly.

Step 11. Position the overflow tube, assemble and tighten the conical gasket and locknut on the bottom of flush tank.

Step 12. Replace the flush tank stopper and linkage (see section in this manual).

Step 13. Use joint compound to seal the connecting pipe, or reinstall flush tank to bowl by tightening flush tank screws to the toilet bowl.

Step 14. Connect the water supply line to bottom of the flush tank. Use joint compound on the threads.

Step 15. Turn on the water valve. Check for leaks.

Step 16. Allow tank to fill. Check for proper operation of flush cycle.

Step 17. Clean up any water and mess.

PROBLEM: Troubleshooting a faulty toilet.

INFORMATION: From the chart, determine the problem and necessary remedy. To replace the ballcock assembly, first, determine the type of assembly of the toilet.

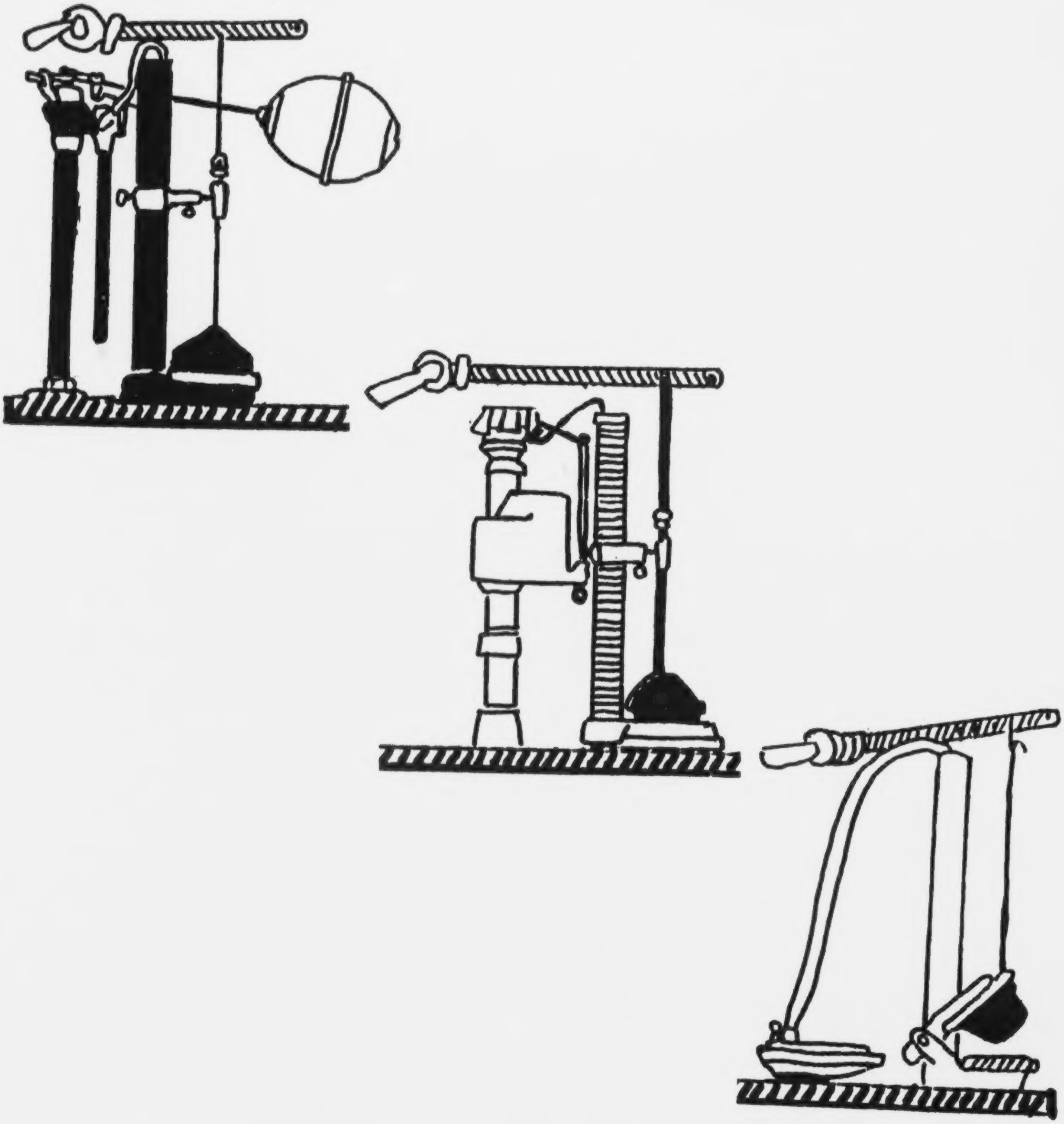

Figure 6.28. Three types of flush mechanisms.

COMMON PROBLEMS, CAUSES AND SOLUTIONS

PROBLEMS	POSSIBLE CAUSES	SOLUTIONS
Noisy tank fill.	Faulty ballcock.	Oil the trip lever, replace faulty washer or install a new ballcock assembly.
	Restricted water supply.	Check fixture stop valve and adjust it.
Toilet running more.	Float arm not rising high enough to stop water flow.	Bend float ball arm down. If float is dragging against side of flush tank, bend away from wall.
	Water filled float ball.	Replace float ball.
	Flush valve seat corroded.	Clean or replace valve seat.
	Flush tank stopper not seating properly in valve seat.	Defective stopper may need to be replaced or adjust guide rod lifting wires or chain.
	Overflow tube cracked.	Replace tube or install new flush valve assembly.
	Ballcock valve will not shut off.	Replace a faulty washer, oil trip lever or replace entire ballcock assembly.
Toilet clogged.	Blocked drain.	See "Plumbing: The Plunger" section in this manual. Remove clog with plunger or closet auger.
Flushing action does not fully clear bowl.	Fault in linkage between trip lever and handle.	Tighten set screw on handle linkage or repair/replace handle.
	Tank valve shuts before the tank empties.	Adjust guide rod liftwires or chain to stopper.
	Leakage between tank and bowl.	Tank bolts need to be tightened. Replace gasket.
	Bowl flush passages clogged.	Use wire hook and clear flush passage.
Sweating flush tank.	Condensation.	Insulate flush tank or install a tempering valve.

TOOLS AND MATERIALS:

Adjustable 12" wrench

Locking pliers

Needle nose pliers

Rags

Screwdrivers, regular and phillips

New ballcock assembly

Penetrating oil

Bucket and towel

THE JOB: Replacing ballcock.

Step 1. Shut off the water supply to the flush tank. This is done at the fixture stop valve on the outside of the toilet.

Step 2. Flush the toilet to remove water from the flush tank.

Step 3. Place a bucket under the flush tank where the water supply line enters the tank.

Step 4. Place locking pliers on the inside of the flush tank and lock onto the nut on the bottom of the tank at the ballcock. Fill the tube base to prevent it from turning.

Step 5. Use an adjustable wrench and loosen the water supply line coupling on the outside bottom of the flush tank.

Step 6. Unhook the water supply line from the bottom of the flush tank.

Step 7. Loosen the nut on the outside bottom of the flush tank.

Step 8. Unscrew the float arm from the ballcock assembly.

Step 9. Remove the refill tube.

Step 10. Lift the ballcock assembly out of the flush tank.

Step 11. To install new assembly reverse the steps used in removing the ballcock.

Step 12. Screw the float arm into the proper position.

Step 13. Reattach refill tube.

Step 14. Open fixture stop valve slowly.

Step 15. Check for leaks at the bottom of the flush tank.

Step 16. Allow the flush tank to fill.

Step 17. Adjust the float arm if necessary.

Step 18. Flush the toilet a couple of times to make sure it is operating properly.

Step 19. Clean up any mess.

INFORMATION: If the source of water is on a hill above the house, electricity will not be needed to get the water into the house. With the cistern above the highest water outlet in the house, the basic system works as shown below.

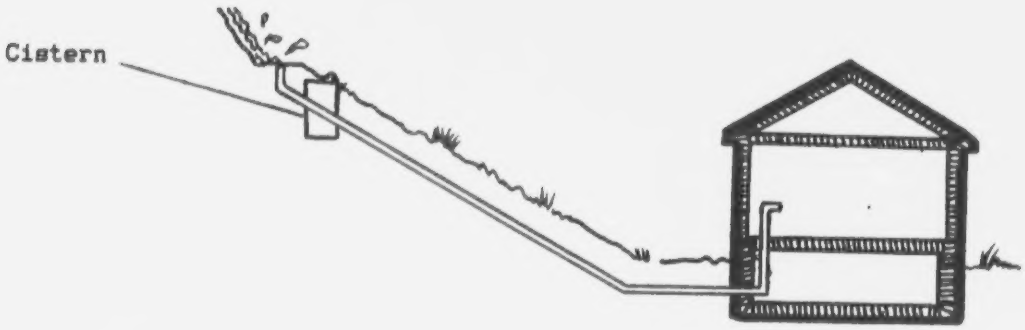

Figure 6.29. Gravity flow cistern system.

A pumped cistern system requires electricity and a control system to shut off the pump when the water is too low. The operation of this system is shown below.

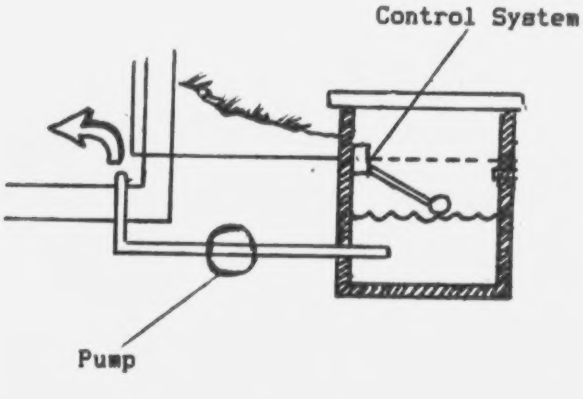

Figure 6.30. Pumped cistern system.

HINTS FOR BEST OPERATION:

Any water line that is outside needs to be protected from freezing. Bury pipes at least 2' to 3' underground. The system should be properly installed.

PERIODIC MAINTENANCE: If the sink does not fill as fast as it use to, there may be a clogged filter. Inspect all filters in the water system on a regular basis. Change them whenever the filter gets dirty.

If there is a sand and gravel filter, replace the sand and gravel periodically with clean material after thoroughly cleaning out the filter container.

COMMON PROBLEMS, CAUSES AND SOLUTIONS

PROBLEMS	POSSIBLE CAUSES	SOLUTIONS
No water.	Low water level. No electricity to pump. Closed supply valve.	Check cistern level. Check electricity to pump. Make sure all supply valves are open.
Low water flow.	Partially closed supply valve. Low pump pressure.	Check for a partially closed valve. Check pump pressure.
Dirty water.	Clogged filter. Contaminated inlet.	Check filters and change if dirty. Check cistern water to see if it is dirty. If so, check cistern inlet for contamination.

CISTERN REPAIR AND REPLACEMENT PROCEDURE: To replace filters, see the directions in the owner's manual.

CALL SERVICE PERSON IF:

1. The lines freeze and burst and leaks cannot be fixed.
2. The pump will not run.
3. The pump runs all the time, even with no one using water.

The cistern is the holding tank for the water supply to the house. The source of water, if not from a public water system, must be purified to protect those using the water.

There are three basic methods to purify the water:

1. Chlorination kills bacteria with chemicals.
2. Pasteurization kills bacteria with hot temperatures.
3. Ultraviolet light kills bacteria with a high intensity special light source.

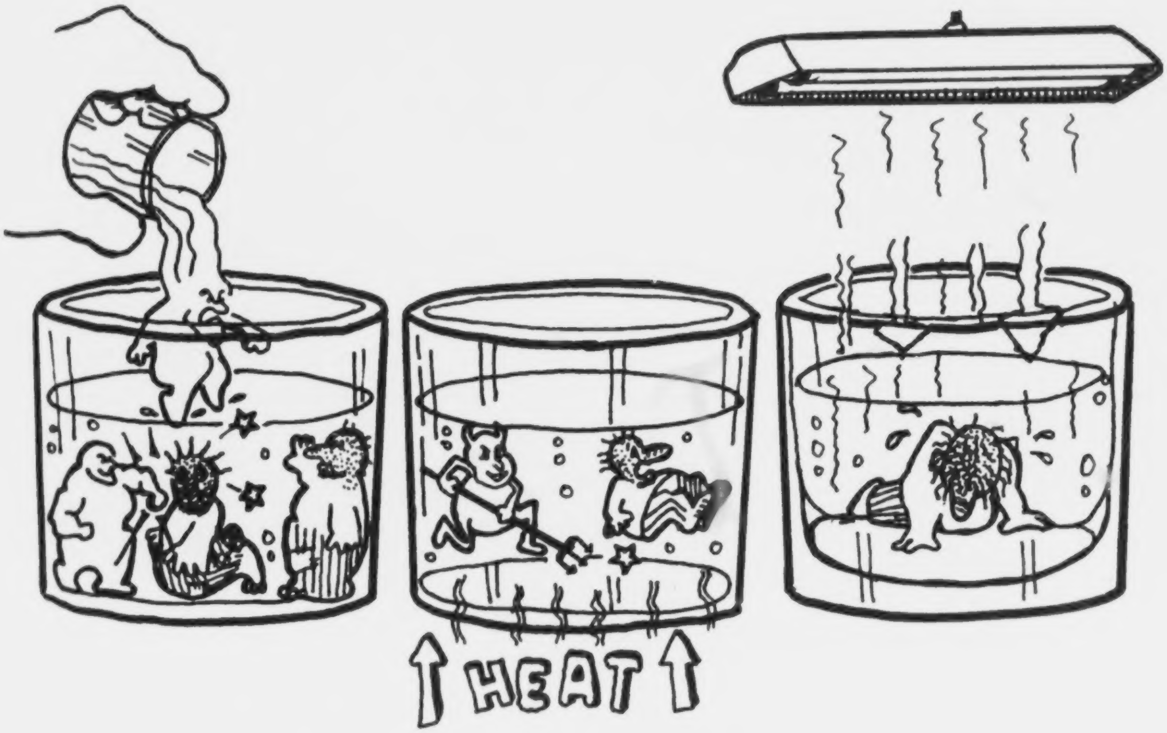

Figure 6.01. Three water purification methods.

These systems need to be installed and serviced by professionals. If there is the slightest question about the water quality, contact a professional.

CAUTION: The health of the family and livestock is at stake. Do not forsake it!

FOR MORE INFORMATION:

CONTACT:

1. Arizona Department of Health Services
   Bureau of Water Quality
   2501 N. Fourth Street, Office 14
   Flagstaff, Arizona 86001

2. The Indian Health Services

3. The Navajo Tribe

4. A good book to read about purifying water is The Home Water Supply by Stu Campbell, Garden Way Publishing, Storey Communications Inc., Pownal, Vermont, 05261.

EXTERIOR MAINTENANCE ....Home Weatherization:

Saving energy is a job for every one in the home. Reducing the energy used in the home means lower gas or electric bills. It may also mean less wood to cut and split. The utility company, energy supplier, or state energy office has a variety of books and papers that will tell how to save energy.

Most homes built since the mid-1970s have energy saving features to cut energy costs. That does not mean that all houses since then will have every energy saving feature. No matter what the type of energy source; wood, coal, gas, electricity or solar, there can be saving on the cost by "tightening-up" the house.

The number one cause of heat loss is called infiltration. That means that heat is lost because cold air comes into the house. Even in the most modern house some heat leaks will develop as the house gets older. Look below at a diagram of a house and see where there can be savings on energy bills. Following the drawing is a discription of how to save energy in each of these areas.

1. Ceiling/Attic
2. Attic Door
3. Fireplace/Flue
4. Door Jamb
5. Window Sills
6. Air Conditioning/ Cooling Units
7. Window Chaulking
8. Threshold
9. Exterior Faucets
10. Floors
11. Walls
12. Ground Vents

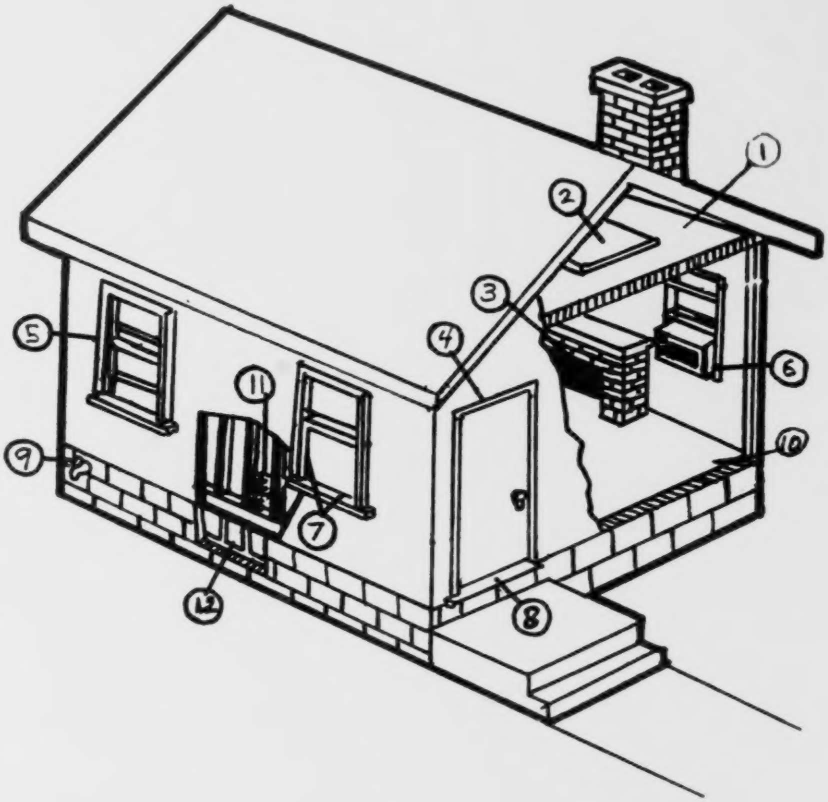

Figure 7.01. Critical areas for weatherization.

SAVING ENERGY IN THE HOME:

1. The attic areas need to be well ventilated. The air needs to move through the area above the ceiling. This can be done with vents or attic fans.

2. The hatch door to the attic often lacks insulation and sealing. There should be some kind of weatherstripping for leaks, and an insulation of at least 6 incles of fiberglass rated R-19.

3. The fireplace,or woodstove damper should be closed whenever not in operation.

4. Check the weatherstripping around the door to be sure they seal tightly against the door jamb.

5. The window caulking should be in good repair.

6. Air conditioners should be well sealed against air leaks by caulking or weatherstripping.

7. Window channel weatherstripping should fit so no cold air comes in.

8. Door thresholds should be in good repair. If not, replace the rubber/plastic gasket. A piece of stripping hung from the bottom of the door can also help.

9. Faucet and wire holes should be caulked and sealed. Faucets should be the freeze-proof type. See "Plumbing" section.

10. The sill plate, where wood begins at concrete block foundation, needs to be caulked against air leaks.

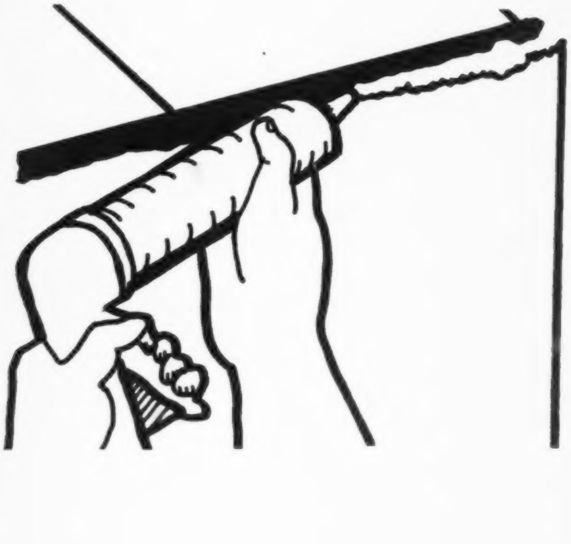

Figure 7.02. Use caulking to prevent air leaks.

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11. Electrical outlets should have foam gaskets to prevent air leaks.

12. Basement windows should also be caulked.

The easiest time to test for air leaks of home weatherization, is to on a cold AND windy day. Wet a hand and run it around the points mentioned to test for air leaks. The air leaks become very noticeable, and will be very easy to feel.

Adequate insulation in floors, walls and ceilings exist in most modern homes. Contact the state energy department to see if the house meets the minimun standards. If not, call the utility company and ask for a cost/benefits analysis for adding more insulation. They will test the home for insulation, and suggest ways to improve the insulation that will lower the utility bills.

PROBLEM: The roof is leaking.

INFORMATION: Leaks are most likely to occur at flashings, at missing or damaged singles, valleys, eaves, chimneys, flues and vent pipes. Locating a leak can be quite frustrating because the water may travel along, under or between layers of material before entering the house.

TOOLS AND MATERIALS:

Ladder

Bucket

Flashlight or droplight

Putty knife

Roof cement

Roofing nails

Patch of sheetmetal

Garden hose

Chalk or crayon

THE JOB: **Repairing Roof Leaks.**

Step 1. To find where the leak comes in the roof, pour water over the leaking areas. Watch where the leak comes through the roof. This can also be checked during a rainstorm.

Step 2. Drive a long nail up through the roof from inside the attic to locate the leak for repair.

Step 3. Position buckets in the attic to catch ALL dripping areas, or the leak(s) could ruin the ceiling.

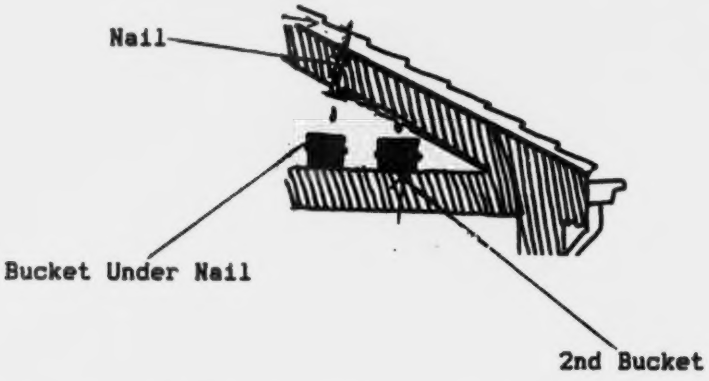

Figure 7.03. Buckets in attic to catch dripping.

Step 4. When the roof is dry, circle the leaking area with a piece of chalk or crayon.

Step 5. Refer to the section on "Exterior Maintenance: Asphalt Shingle Repair" to fix the leak permanently.

EMERGENCY REPAIRS:

1. From inside the attic, use a caulking gun or putty knife to spread roof patch putty, or silicone caulking on the leaking area. To be safe, put buckets under the area, because the leak may be slowed down, but not stopped completely.

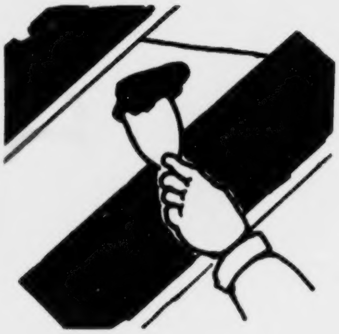

Figure 7.04. Emergency patching with roof cement.

2. After the roof has dried, slide a piece of sheet metal under the row of shingles above the damaged place so that it overlaps. Use aluminum or galvanized steel.

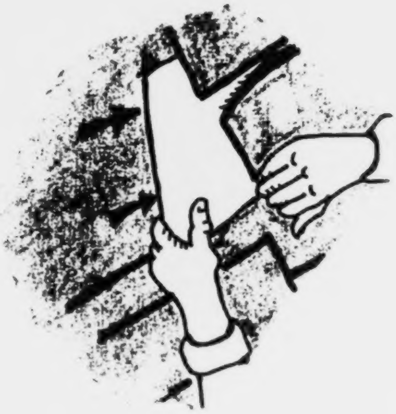

Figure 7.05. Emergency patching with sheet metal.

PROBLEM: Cracked, torn, curled or missing shingles.

INFORMATION: Asphalt shingles are made of mats of organic or fiberglass material in which colored mineral granules are mixed in. Shingles are nailed to the roof with galvanized roofing nails, with large heads.

A layer of black asphalt coated 15# or 30# felt paper is nailed onto the roof surface starting at the eaves. Each overlap each layer until the peak or ridge of the roof is reached. This is done before nailing on the shingles. Shingles are nailed to the roof starting at the eaves. This layer of roofing by the eaves, is a double layer which is staggered to start the roof patter. Each row of shingles is lapped over the row nailed underneath it. Continue to overlap each row of shingles until the peak or ridge of the roof is reached. This overlapping allows rain to run over NOT UNDER the shingles.

TOOLS AND MATERIALS:

Ladder

Hammer

Putty knife

Flat prybar

Wood block

1 1/2" roofing nails

Roof cement

THE JOB: **Replacing Or Repairing Asphalt Shingles.**

Step 1. The best time to do this job is on a warm day or when the sun is on the bad section of the roof. Warm shingles are easier to work with than cold shingles which are brittle and easy to break. Roofing cement should be applied to a warm surface.

Step 2. To flatten a curled shingle:

A. Put roofing cement under the curled part and press it down.

B. Nail it down with roofing nails, which have wide heads, and are made of aluminum, or are galvanized to prevent rust.

C. Cover the nail heads with a smooth dab of roofing cement.

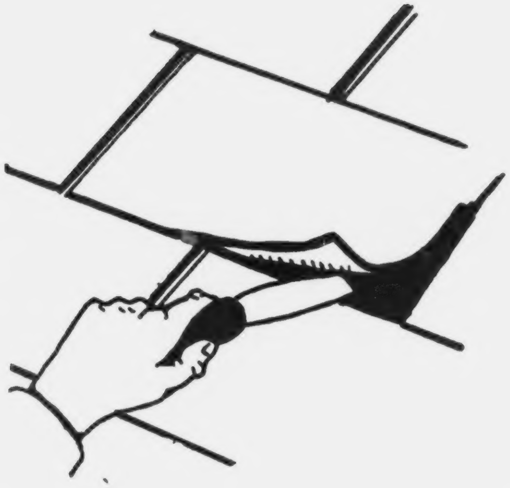

Figure 7.06. Repair curled shingle.

Step 3. Torn shingle repair:

A. Smear roofing cement under the tear and press the shingle back into place.

B. Tack each side of the tear down with roofing nails.

C. Cover everything in the repair with a coat of roofing cement.

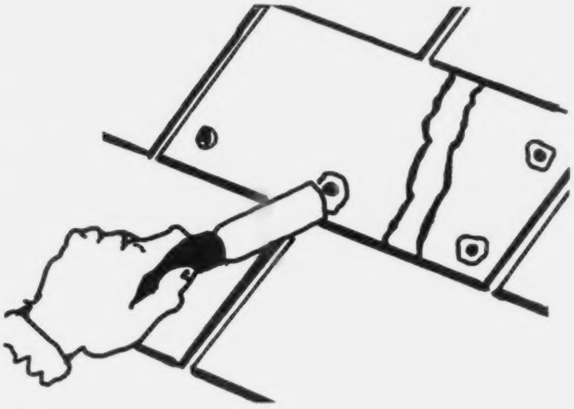

Figure 7.07. Repair torn shingle.

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Step 4. Small cracks. Use roofing cement to mend the crack. Apply the roofing cement along the crack with a putty knife.

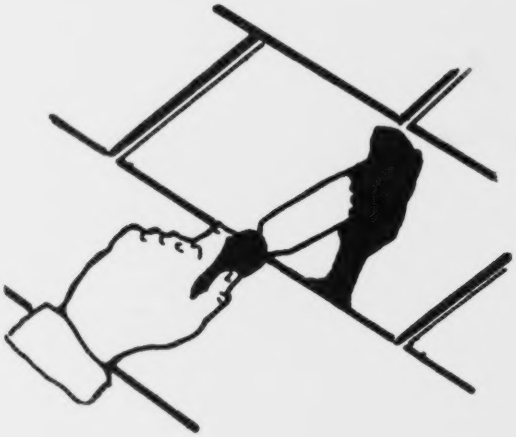

Figure 7.08. Repair cracks in shingles.

Step 5. Replacing a missing or badly damaged shingle:

A. Raise the shingles above the damaged shingle with a prybar.

B. Use the prybar to pull out the nails holding the damaged shingle.

C. Slide the new shingle into place. Do not damage the felt underneath the shingle. Trim the top corners to make if easier to slide into place. Line it up carefully to match the pattern of the old shingles.

D. Nail the new shingle into place while carefully lifting the shingle above it.

E. Lower the upper shingle back into place.

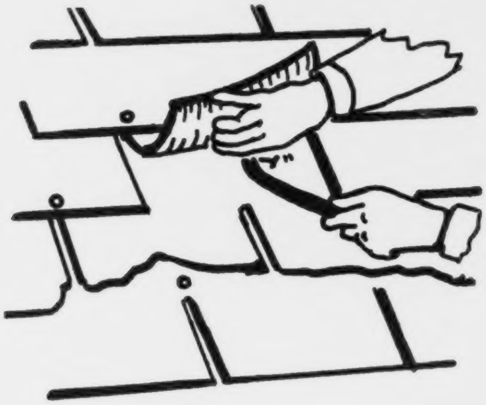

Figure 7.09. Replace entire shingle.

PROBLEM: The rain gutter is clogged during a storm, and the rain water is running over the top of the gutter and down the side of the house.

INFORMATION: Gutters and downspouts are usually made of galvanized steel, aluminum, or vinyl (plastic). They are attached to the roof eaves at the fascia board by a strap, bracket, spike, or hanger.

For gutters to work effectively they must be sloped towards the downspout, be in good repair with no holes or sags, and be free of leaves, pine needles, and dirt.

TOOLS AND MATERIALS:

Hammer

2' level

Putty knife

Tin snips

Gloves

Garden hose

Ladder

Plumbers snake

Silicone caulking

Roofing cement

Wire brush

Sheet metal patches

Caulking gun

Replacement parts for broken gutters or downspouts

THE JOB: **Repairing Or Unplugging Rain Gutters.**

Step 1. To unclog gutters:

A. Put on gloves and remove leaves, etc.

B. To prevent this in the future, special sections of screens are available to fit over the gutters.

Step 2. To unclog downspouts:

A. Put a garden hose at the top of the spout and flush the pipe. If the water is hauled or limited follow Step B.

B. If Step A does not work, try using a plumbing snake.

C. To prevent this in the future, place leaf strainers or screen over the downspout opening.

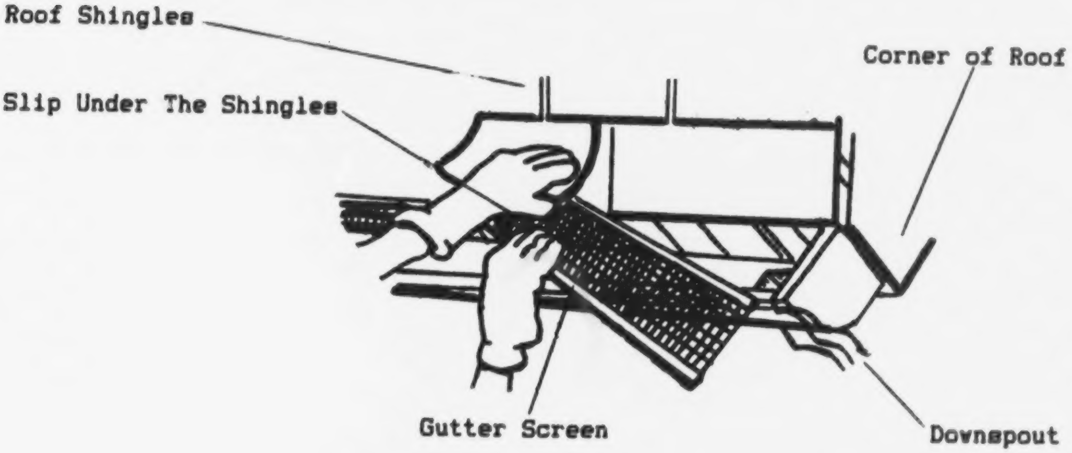

Figure 7.10. Screens may prevent clogged gutters.

Step 3. Sagging gutters. If water overflows from the gutters, it can soak the wood beneath and cause rotting. Using a hammer and a level, adjust the brackets so that the gutter slopes down evenly to the downspout. Typical slope is about 1/8" of a drop for every foot of length.

Step 4. Leaks in gutters might occur at joints, or around small holes and cracks.

A. Leaking joints can be sealed by using silicone caulking around the seams or joints between sections. Do this on the inside and outside. Do it ONLY on a dry surface.

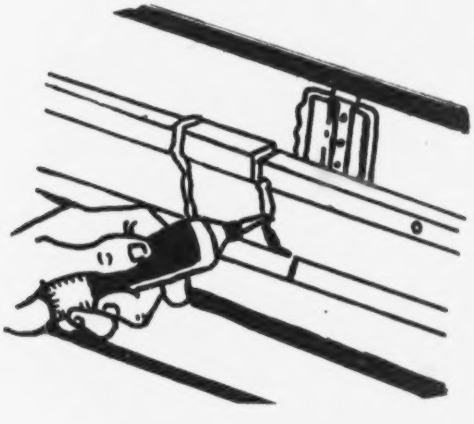

Figure 7.11. Repair leaking joints with caulking.

B. Small holes can be sealed by using roofing cement. Smear the roofing cement well beyond the hole in all directions.

C. Larger holes will need a layer of roofing cement, then a metal patch with another layer of roofing cement.

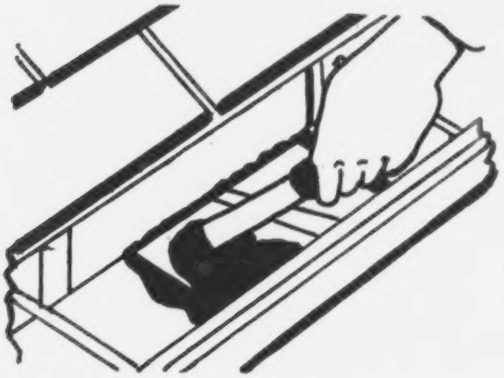

Figure 7.12. Repair large holes with roofing cement.

D. Repairs to vinyl or "plastic" gutters can be done with pieces of the same vinyl cemented on as patches.

PROBLEM: Cracks, small or large holes are in the outside of stucco walls.

INFORMATION: Stucco is usually applied in 3 layers or "coats" over wire mesh and felt paper or insulating sheathing that were nailed to the outside of a wall surface.

To mix stucco combine 1-part of portland cement to 3-parts of coarse clean sand (NO dirt) with 1/10 part of hydrated lime. Mix these with CLEAN water to form a stiff paste.

Or, buy stucco-mix that just needs water added. If the job is large, it would take many boxes of stucco-mix. That could cost a lot.

TOOLS AND MATERIALS:

Cold chisel

Hammer

Wire mesh

Tie wire

Pliers

Putty knife or masons trowel

If you mix your own own stucco:

Wheelbarrow or big bucket

Water

Shovel

THE JOB: **Repairing Stucco.**

Step 1. Remove loose stucco from the hole with a cold chisel and hammer. Blow away the dust. Staple or tie the new wire mesh ove the damaged mesh. WET all the area with water.

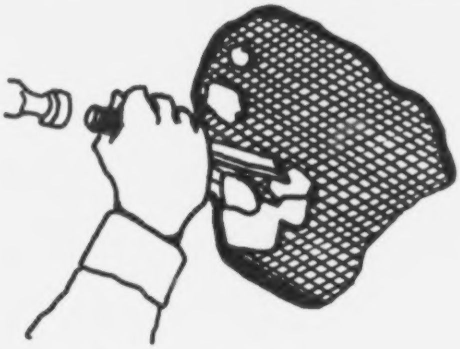

Figure 7.13. Removing loose pieces of stucco.

Step 2. Apply the first coat. The stucco should go on through the mesh. Fill to within 1/4" or so of the surface. When it has become semi-hard, scratch groves in the surface to hold the next coat. Let the patch cure (dry) for 2 days.

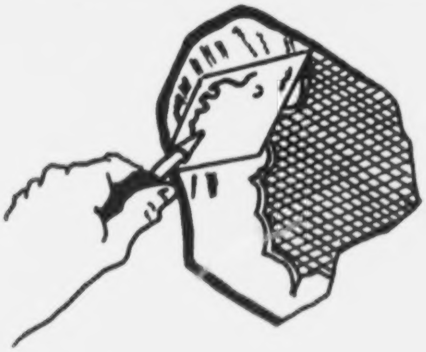

Figure 7.14. Coat 1, thin layer.

Step 3. Wet the previous coat. Apply the second layer to within about 1/8" of the old surface. Smooth the surface. Let it dry for 2 days again.

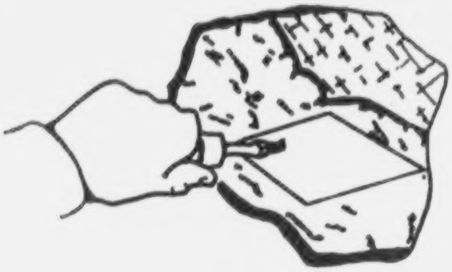

Figure 7.15. Coat 2, 1/8" inside surface.

Step 4. Wet the second layer. Apply the final coat with a trowel, smooth and even with the old surface. Match the surrounding texture. Allow to dry for 4 days. Then paint.

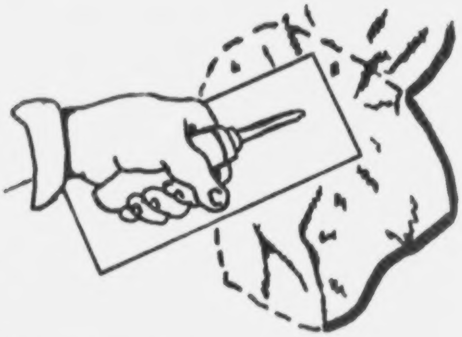

Figure 7.16. Coat 3, smooth with surface.

CAUTION: To avoid cracks, do not allow damp stucco to freeze. Keep out of the direct sun while drying. Use only clean materials. Do no try to shorten the drying times between layers.

PROBLEM: Cracks or holes in outside Powervall* covered walls.

INFORMATION: Powervall* is very much like stucco in appearance. The major difference is the addition of fiberglass fibers to the mixture. Powervall* can be patched with a stucco patching mixture, but the texture will be different. Also, it may be difficult to match the color of the home's outside walls. Getting a supply of Powervall* may be difficult. Ask the contractor who built the house where to find some, or contact Powervall* of Arizona in Phoenix.

TOOLS AND MATERIALS:

Cold chisel

Hammer

Wire mesh

Tie wire

Pliers

Putty knife or masons trowel

THE JOB: **Repairing or patching Powervall***

NOTE: **Refer to the previous section on "Patching Stucco".**

Step 1. Follow all of the steps in the "Patching Stucco" section to prepare the patch area.

Step 2. Mix the Powervall* to a thick paste using small amounts of clean water. The color should be very similar to the old Powervall*.

Step 3. Using a trowel or large putty knife apply the Powervall* to the wet area to be patched. It should go through the wire mesh.

Step 4. Trowel the patch until it is level with the rest of the wall. It may be hard to match the existing Powervall*. The original wall was sprayed on.

Step 5. Using a spray bottle with water or damp cloth, keep the Powervall* patch's surface MOIST, NOT soaked, for a few hours. Keep from direct sun or from freezing.

Step 6. Clean all tools immediately.

*Trademark

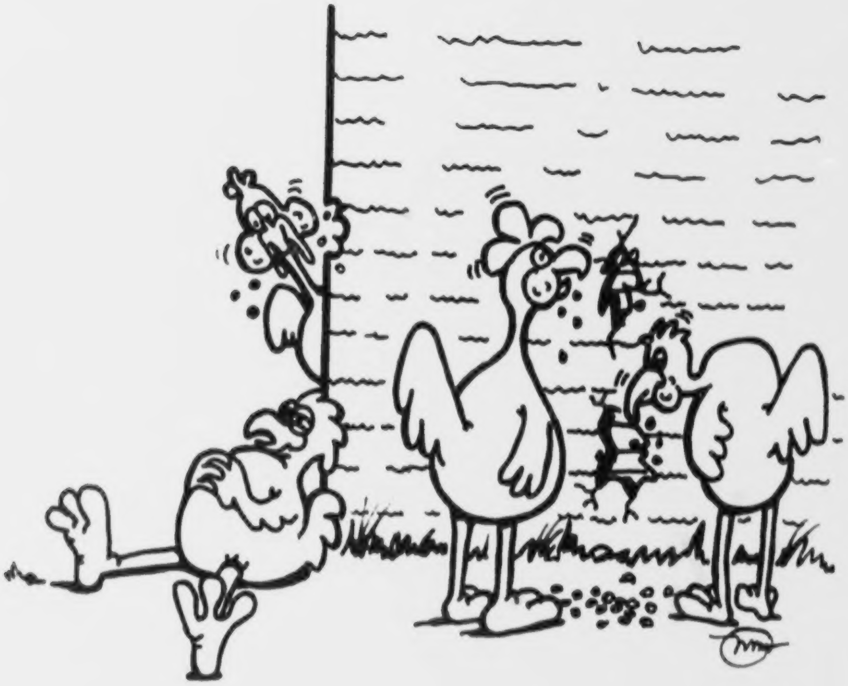

Figure 7.17. Powerwall* and chickens.

POWERWALL* AND CHICKENS

PROBLEM: Chickens or other poultry are pecking holes in the house's outside walls.

INFORMATION: Chickens do this because they need gravel for digestion. In an area where gravel is rare, it may be easier for poultry to use the walls as a convenient source for small stones, instead of finding them in the soil.

SOLUTION: Provide SMALL gravel, pea size and smaller, in areas away from the wall. Either put the gravel in pans or spread enough of it on the ground so the sand will not cover the gravel up right away. A bag of cracked oyster shells may be purchased at the feed store for the same purpose. Resupply often. Screen the chickens off with a temporary fence to break their habit of pecking on the walls.

PROBLEM: Paint failure indicated by:

1. Blistering, is caused by moisture inside the house trying to escape to the outside. The moisture "pushes" the paint off the wall in blisters.

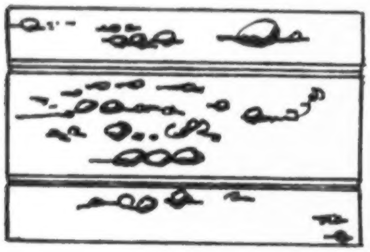

Figure 7.18. Blistered paint.

2. Peeling, which is usually caused by painting over wet, dirty or greasy wood.

3. Alligator effect, which is usually caused by a new paint put on over old paint which causes the two paints not to stick together.

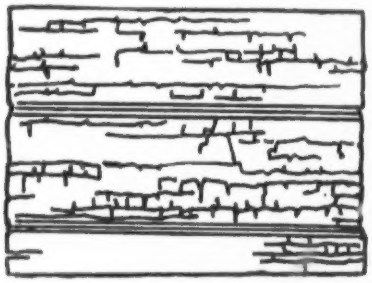

Figure 7.19. Alligator effect.

4. Wrinkling, which is usually caused by paint put on too thick.

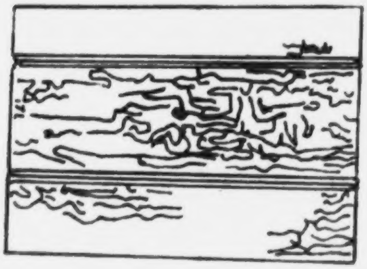

Figure 7.20. Wrinkling paint.

5. Chalking, is when a dusty color comes off on the hand if it is brushed across the paint. This may be caused by cheap paint, improper priming or painting when it was too cold.

INFORMATION: Choose the right paint for the job! Paint stores can help in picking out the best type of paint.

REMEMBER: Painting should be done when the weather is not too hot or too cold. Read the instructions on the paint can.

TOOLS AND MATERIALS:

Good ladder(s) for the highest points

4" quality paint brush

2" quality paint brush

Paint roller

Roller pan

Paint roller extension handles

Putty knife

Caulking gun

Paint scrapper

Wire brush

Drop cloths

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TOOLS AND MATERIALS:

Paint thinner

Several tubes of caulking

Enough paint to cover the area

Wood putty

CAUTION: Store paint rags outside in a metal container. They can catch fire without anyone adding a match. This is called spontaneous combustion.

THE JOB: Painting Exterior Surface.

Step 1. Check these points before painting:

A. Caulking at windows, doors and other joints should be in good shape.

B. Check the flashing.

C. Downspouts and gutters should be repaired. Dripping water may cause rapid paint breakdown.

D. The putty around window panes should be checked and repaired.

E. Holes or cracks in the wood should be filled with wood putty.

F. Scrape or use a wire brush on the damaged painted areas.

G. Sandpaper should be used to smooth rough paint and rough wood.

H. All surfaces should be very dry and very clean.

Step 2. Paint in this order:

A. Work horizontally around the house's larger surfaces.

B. Start at the top and work down.

C. Paint the trim, decks, and doors.

Step 3. IMPORTANT! CLEAN all brushes, rollers, pans, etc., completely at the end of each day with the recommended cleaner to prevent them from becoming ruined. Dried paint cannot be removed. Equipment that is not cleaned cannot be used again.

PROBLEM: The area around the house is being washed away by the rain or the wind is blowing dust and sand into the house. This can cause erosion around the home.

INFORMATION: When the house is built much of the natural vegetation is destroyed or removed. This can cause the rain and wind to cut gullies and create mounds of sand around the house. Landscaping around the house will not only prevent this but will improve the looks of the home. This is usually done by planting vegetation that will grow well in the area. Consider the amount of care and water needed before deciding what to plant. Consult a nursery if different plants other than the natural plants that may grow in the area are plantd.

TOOLS AND MATERIALS:

Gardening tools: Shovel
- Hoe
- Rake

Potting soil

Plants

Plant food

THE JOB: Planting Landscape.

Step 1. Look around the house for areas that are being eroded by the rain or wind. Notice how the water flows around the house. Direct any run off to the plants.

Step 2. Fill in any run off areas. If erosion of the area under the downspout is occurring, place cement or a rock there to help prevent this.

Step 3. Prepare the area for planting. The way the soil should be prepared will depend on the type of plants to be planted. If placing natural plants back into the area, keep as much of the natural soil around the roots as possible.

Step 4. Once planted, care must be given to the plants. Occasional watering is recommended to insure that the new roots take hold. There may be a need for regular watering if the plants are not natural to the area. The use of plant food or fertilizer will help the plants grow faster and be healthier.

INTERIOR MAINTENANCE . . . . Carpet/Furniture Cleaning:

PROBLEM: Stained or dirty carpet or furniture.

INFORMATION: The cleaning and maintenance of carpets, area rugs, and furniture can be handled by the homeowner vacuuming weekly. A program of shampooing, to preserve the beauty, and lengthen the life of these home items, should be done once a year. This can be done by renting carpet or furniture steam cleaners from local stores.

TOOLS AND MATERIALS:

Rented rug cleaning machine

Rug cleaning solution (usually 2 oz. per gallon of water does 100 square foot of carpet).

Vacuum cleaner

Special stain removers (see chart).

PROBLEM AND SOLUTION STAIN REMOVAL CHART

PROBLEM STAIN	SOLUTION
Soft drinks, food and alcoholic beverages.	Washable fabrics: Rinse area with cool water right away. Then rub detergent into the stain. Rinse with cool water using a sponge. If stain remains, sponge with a mixture of 1-part white vinegar to 2-parts water. Non washable fabrics: Apply cool water to the spot using a sponge right away. Then use liquid detergent on it and rinse the stain thoroughly. Use isopropyl alcohol to rinse the stain again, making sure all the detergent is rinsed out. CAUTION: Test the fabric first in an unseen area, the alcohol may remove or fade the fabric color.

PROBLEM STAIN	SOLUTION
Oily materials such as butter, lard, or mutton stew.	Washable fabrics: Make a paste of laundry detergent by following directions on the detergent box. Hand wash or machine wash in warm or hot water. If there is a stain left, try special grease solvents which are available at the supermarket or discount store.
	Nonwashable fabrics: Dry cleaning fluid will be needed. It is available at drug stores and grocery stores. Apply the fluid. Let it dry to a powder. Then, brush off the powder. Repeat the procedure several times until the stain is gone.
Blood, animal stains, or feces.	Washable fabrics: Rinse area with cold water then use a sponge with cool water on the stain right away. Rub area with laundry soap. Rinse with cool water. If stain remains, sponge with a mixture of 1-part white vinegar to 2-parts water.
	Non washable fabrics: Rinse area with cold water right away. Apply cool water with a sponge. Then use liquid soap on stain and rinse thoroughly. Use rubbing alcohol to rinse the stain again making sure all the detergent is out of the fabric. CAUTION: Test the fabric first in an unseen area, the alcohol may remove or fade the fabric color.
Chocolate, grape juice, or spaghetti sauce.	Washable fabrics: Rinse area with cool water right away. Then rub liquid soap into the stain. Rinse with cool water. If the stain remains, sponge with a mixture of 1-part white vinegar and 2-parts water solution.
	Non washable fabrics: Apply cool water to the spot using a sponge right away. Then use liquid detergent on it and rinse the stain thoroughly. Use isopropyl alcohol to rinse the stain again, to make sure all the detergent is rinsed out. CAUTION: Test the fabric first in an unseen area, the alcohol may remove or fade the fabric color. If necessary, after the area is completely dry, use dry cleaning fluid to finish removing the stain.

PROBLEM STAIN	SOLUTION
Heavy grease such as lipstick, crayon or chewing gum.	Washable fabrics: Rinse area with cool water right away. Then rub liquid soap into the stain. Rinse with cool water. If that does not do the job, sponge with a mixture of 1-part white vinegar and 2-parts water solution. If the stain still remains, try making a paste of laundry detergent by following the directions on the detergent box. Hand wash or machine wash in warm or hot water. If there is stain left, try special grease solvents. A hand cleaner or professional spot remover may also be used. Non washable fabrics: Apply cool water to the spot using a sponge right away. Then use liquid detergent on it and rinse the stain thoroughly. Use isopropyl alcohol to rinse the stain again, to make sure all the detergent is rinsed out. CAUTION: Test the fabric first in an unseen area, the alcohol may remove or fade the fabric color. If necessary, after the area is completely dry, use dry cleaning fluid to finish removing the stain.
Automotive grease.	Washable fabrics: Add water to cornmeal or cornstarch to form a paste. Apply paste to the stain and let dry. Gently brush off fabric or try using a hand cleaner immediately before washing. Non washable fabrics: Repeat as directed in washable fabrics above.

NOTE: **Nail polish remover may remove many stains that are not listed. CAUTION: Test the polish remover on an unseen area in the fabric. The polish remover may remove and/or fade the fabric color or damage the material. DO NOT USE on acetate fabrics, call for professional help!**

THE JOB: Preparing To Clean Rugs And Furniture.

Step 1. Remove furniture in area to be cleaned.

Step 2. Repair all carpet tears and loose seams.

Step 3. Use scissors to trim all loose threads.

Step 4. Vacuum carpets, or clean thoroughly both sides of area rugs, and all sides of furniture.

Step 5. Remove any stains (see chart).

Step 6. Repair crushed piles or curled corners of rugs by laying a damp cloth over the damaged area and using a steam iron on it with very light pressure.

THE JOB: Cleaning Rugs And Furniture.

Step 1. Rent the rug cleaning machine. Be sure to get the furniture attachments.

Step 2. Test clean a hidden piece of material with the detergent to be used, to make sure it does not remove or fade the color.

Step 3. Follow the instructions on the machine.

Step 4. Clean the areas used a lot, at least two times. These may include:

A. Heavily used areas for rugs are hallways, entry ways, or stairs.

B. Heavly used areas for furniture are arms, seat cushions, or foot rests.

HELPFUL HINTS

1. Clean stains as they happen.
2. Put cardboard under the edges of area rugs while cleaning to protect floors.
3. Avoid over wetting material while cleaning by using twice the number of dry vacuum strokes (see machine instructions).
4. Let carpet or furniture dry overnight before using.
5. Do not put furniture on damp carpets. Wait until they are dry.
6. After cleaning, protect material by applying a soil retardent or water repellant. These products can usually be purchased where the cleaning machine was rented. They are easy to use.
7. For maintenance of wood parts of the furniture, see the section on "Wood Care" in this manual.

PROBLEM: Scratched, pocked, or stained floor tiles.

INFORMATION: To keep tile or vinyl floor looking nice, keep them clean. They should be swept and mopped as they get dirty. When floor tiles become scratched, dented or stained they may sometimes be repaired without having to be replaced.

TOOLS AND MATERIALS:

Scraper

Putty knife

Steel wool

Lacquer or varnish

Linseed oil

Hammer

THE JOB: Repairing The Surface Of Tile.

Step 1. Get scrapings from a matching tile and grind or pound to powder.

Step 2. Mix powder with lacquer or varnish to a paste consistancy.

Step 3. Smooth paste into damaged areas with putty knife.

Step 4. Let paste dry.

Step 5. Rub smooth with steel wool and boiled linseed oil.

THE JOB: Removing Stains.

Step 1. Listed below are the most effective stain removers for tile surfaces, in order of effectiveness:

A. Chlorine bleach

B. White vinegar and water

C. Hydrogen peroxide

D. Rubbing alcohol

E. Household ammonia

F. Lighter fluid

G. Nail polish remover

NOTE: If none of these remove the stain see section "Tile: Replacement".

PROBLEM: Damaged linoleum tiles or curled corners.

INFORMATION: While the most common tile repair is resticking curled tiles, some tiles are so damaged they need to be replaced.

TOOLS AND MATERIALS:

Torch and or iron

Putty knife

Hammer and wood chisel

Linoleum or razor knife

Straight edge

Small notched trowel

Floor adhesive

Replacement tile

THE JOB: Removing and replacing tile.

Step 1. Use a torch or hot iron, to apply heat to the damaged tile until the adhesive softens.

NOTE: Only use a hot iron on tiles with curled corners.

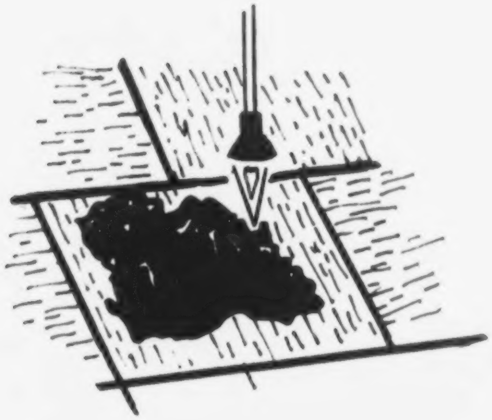

Figure 8.01. Heat the damaged floor tile.

Step 2. If possible work from the corners to the center with a putty knife to peel up the tile or use a hammer and wood chisel from the center to the edge.

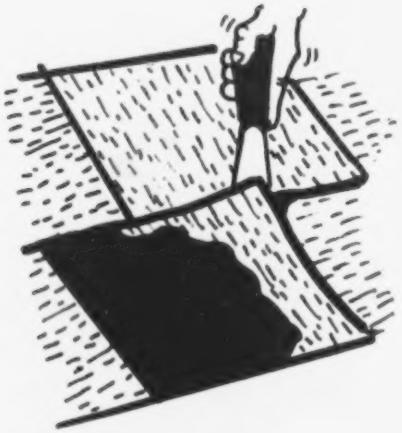

Figure 8.02. Remove damaged floor tile.

CAUTION: Use caution to avoid damaging surrounding tiles with sharp metal tools.

Step 3. Use putty knife to remove ALL the old adhesive from the floor.

Step 4. Fit replacement tile into opening. Use a straight edge and knife or sand paper to assure a tight fit.

NOTE: Replacement tile should match the pattern of other tiles.

Step 5. Apply adhesive according to product directions.

CAUTION: Do not use too much adhesive. It keeps coming up between the tiles and can be messy.

Step 6. Preheat replacement tile. When it is flexible, fit in place and weight it down until the adhesive is completly dry.

PROBLEM: Damaged sheet flooring.

INFORMATION: Worn, torn or impressioned sections of linoleum and vinyl are easily replaced with a matching piece of material larger than the damaged area.

TOOLS AND MATERIALS:

Metal straight edge

Razor knife

Tape

Adhesive and spreading tool

Replacement piece of sheet flooring

Putty knife

THE JOB: Replacing bad area of flooring.

Step 1. Place a new piece of flooring over the damaged area. Match existing pattern exactly and tape the section in place.

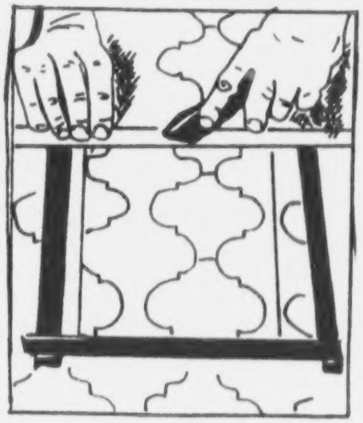

Figure 8.03. Overlay new section of flooring and tape securely.

Step 2. Use a straight edge and razor knife to cut through BOTH layers of sheet flooring. Remove a section larger that the damaged area.

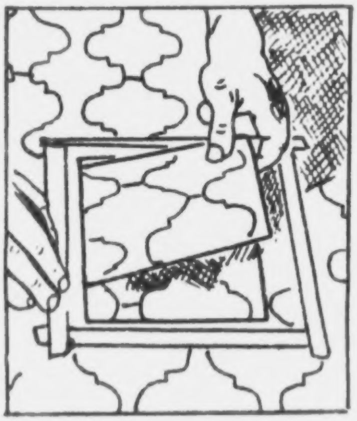

Figure 8.04. Cut through both layers of sheet flooring.

Step 3. Remove both layers of the sheet flooring.

Step 4. Clean the surface area where patch will go.

Step 5. Trim the patch piece to fit exactly.

Step 6. Apply adhesive to the back of patch piece.

Step 7. Fit the new piece in the patch area. Do not overlap.

Step 8. Weight down the patch until the adhesive is dry.

PROBLEM: Holes, dents, cracks, or seam separations of wall board or plaster walls.

INFORMATION: When cracks or seam separations need repair, it is important that the movement or settling of the wall has stopped if the repair is to last. All wall repair work must be followed by touch-up painting or repainting of the repaired surface.

TOOLS AND MATERIALS:

DRY WALL REPAIR:

Straight edge

Trim knife

Crown head hammer

Dry wall nails or screws

4" finishing knife

Sandpaper

Wall board, joint compound and tape

PLASTER REPAIR:

Plaster or spackling compound

Flexible putty knife

Wire mesh, expanded metal or heavy hardware cloth

Sand paper

Brush

THE JOB: Repairing seam separations in wall board.

Step 1. Peel off old wall board tape over separated seams.

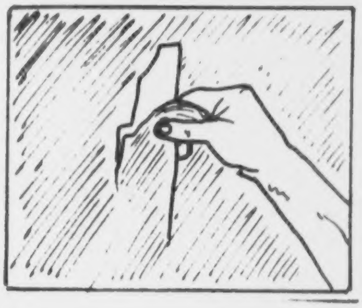

Figure 8.05. Remove bad section.

Step 2. Sand the area to be repaired until it is smooth.

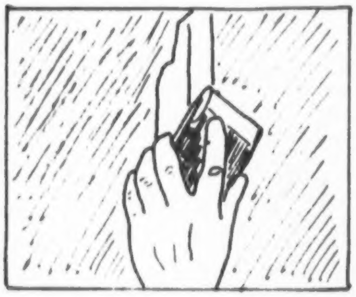

Figure 8.06. Sand until smooth.

Step 3. Apply new tape to the seam with joint compound. Use a finish knife to smooth the edges to the surrounding surface area. The tape should be flat on the surface, with no bulges.

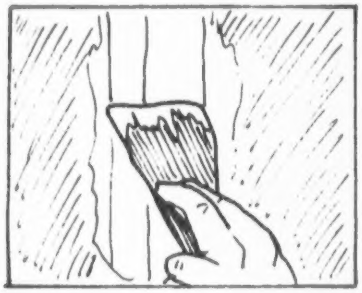

Figure 8.07. Replace with new tape and finish with joint compound.

Step 4. Wait 24 hours and apply a thin coat of joint compound over the seam.

NOTE: Joint compound is very slow drying and is subject to shrinkage.

Step 5. After the final layer of joint compound is dry, use sandpaper for the final smoothing. If wall is textured, you may want to add a texture to the seam to match the wall.

Step 6. Paint the repaired area with primer.

Step 7. Apply finish paint.

THE JOB: Repairing Dents In Wall Board.

Step 1. Fill dent with joint compound, smooth over with a finish knife.

Step 2. Let compound dry and apply a second coat, if necessary.

Step 3. Sand it smooth.

Step 4. If the wall is textured, add a thin coat of compound to the surface and apply matching texture.

Step 5. Apply primer paint to the repaired area.

Step 6. Apply finish paint to the repaired area.

THE JOB: Repairing Holes In Wall Board.

Step 1. Use a straight edge and trim knife to cut out an area around the hole that will leave repair seams over existing wall studs.

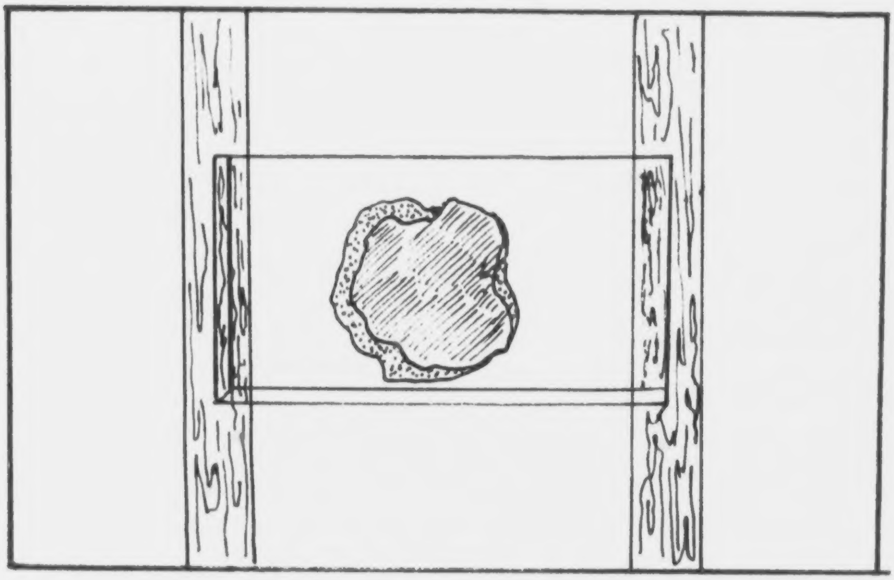

Figure 8.08. Cut out the damaged area to the wall studs.

Step 2. Use a straight edge and trim knife to cut a replacement piece of wall board, using the removed piece for a pattern.

NOTE: Wall board comes in 3 standard thicknesses: 3/8", 1/2", and 5/8". Be sure to match the patch thickness to the existing wall thickness.

Step 3. Use drywall nails to install the patch in the cut out area.

Step 4. Repair seams around patch by following previous directions given in the "Repairing Seam Separations".

THE JOB: Repairing cracks in plaster walls.

Step 1. Depending on size of crack, use a trim knife or larger metal tool to cut back the sides of cracks and remove loose bits of plaster.

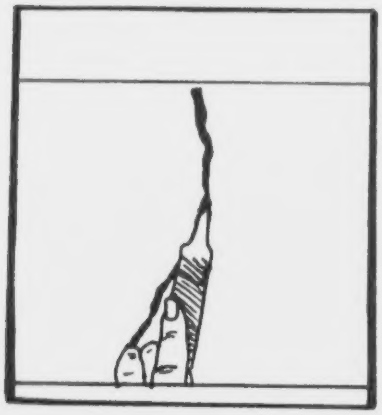

Figure 8.09. Remove loose pieces of plaster.

Step 2. Use a brush to wet the area to be repaired. Make sure the wall is wet to the depth of the crack.

Step 3. Mix plaster to a paste and force into the crack with a putty knife.

Step 4. Let this dry and apply more if necessary due to shrinkage.

Step 5. Sand the area smooth unless textured.

Step 6. Apply the primer paint.

Step 7. Apply the finish paint.

THE JOB: Repairing Holes In Plaster Walls.

Step 1. Use trim knife to cut the back edges of the hole to smooth and stablize plaster.

NOTE: For small holes skip to Step 3.

Step 2. For large holes install backing support. (Wire mesh, expanded metal, heavy hardware cloth.)

A. Cut out a piece of wire mesh slightly larger that the hole.

B. Run a piece of wire through the center of the wire mesh.

C. Insert the wire mesh through the hole. Pull on the wire to smooth mesh against the inside of the hole.

D. Twist the wire around a piece of wood to hold the wire mesh in place.

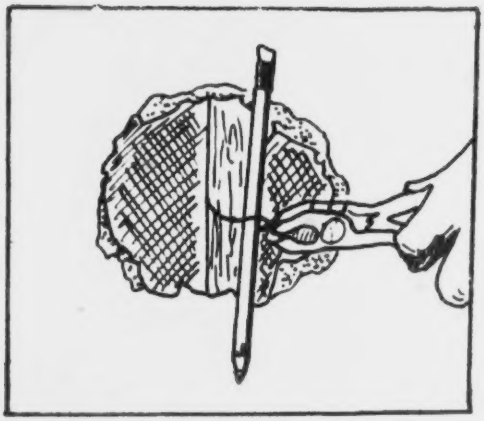

Figure 8.10. Secure wire mesh inside the hole.

Step 3. Use a brush to thoroughly wet the area around the hole to the depth of the hole.

Step 4. Apply a plaster coat covering to the entire mesh area. Smooth it up to the full wall thickness around the edges.

Step 5. Let this dry. Gently remove the wood support.

Step 6. Cut the wire flush with the plaster.

Step 7. Apply a finish coat of plaster using a straight edge to smooth the plaster even with the wall.

Step 8. Let this dry. Sand smooth unless textured.

Step 9. Apply primer paint.

Step 10. Apply finish paint.

THE JOB: Painting the wall repair.

Step 1. Select a proper brush or roller for surface to be painted.

NOTE: If existing surface of the wall is textured use spackling compound. Use a roller or trowel to match the repaired area to the wall before painting.

Step 2. Paint with primer.

Step 3. Paint with matching finish coat.

NOTE: If matching paint is unavailable, the entire wall must be repainted.

Step 4. If care is used in cleaning and storage of brushes and rollers, they can be used again.

A. Clean brushes or rollers immediately after use. Do not allow paint to dry in brushes or on the roller.

B. Use the right solvent to clean oil base, alkyd. schellac or alcohol base paint from brushes and roller. Read the product instructions.

C. If a latex paint is used, all brushes and rollers may be cleaned with hot soapy water.

D. Wrap brushes or rollers in aluminum foil or heavy paper to prevent bending or crushing of bristles and nap after they are dry.

E. Store the brushes or roller until you need them again. A good quality brush can last years, if taken care of!

PROBLEM: Wood finish has minor scratches or gouges through the finish.

INFORMATION: Repairing of minor or moderate scratches, or checking patterns of surface cracks in varnish or lacquer is a simple job. Isolated deep scratches can usually be repaired without refinishing the entire piece. First, determine the type of finish to be repaired and the type of repair needed.

TOOLS AND MATERIALS:

The right solvent for finish (see product instructions).

Stick shellac

Spatula

Benzine

Small brush

THE JOB: Repairing minor scratches or checking in a wood surface.

Step 1. Clean the surface with Benzine.

Step 2. Use the right solvent for finish (example: turpentine for varnish and lacquer thinner for lacquer).

Step 3. Brush the area surrounding the scratch with solvent until the finish softens and flows into the scratch.

Step 4. After fully dry, rub with a felt pad or with 4/0 steel wool.

Step 5. Apply wax and rub.

Step 6. To repair checked varnish surface:

A. Clean with a stiff brush and mild detergent. Let dry.

B. Apply solution: 2-parts turpentine, 3-parts varnish, 4-parts boiled linseed oil. Rub mixture into the surface and let it dry.

C. If cracks remain in the finish, repeat the above procedures.

THE JOB: **Repairing deep scratches or gouges.**

Step 1. Extremely deep gouges must be filled to the surface level with wood putty colored to match the wood surface.

Step 2. Scratches in wood or putty filled gouges should receive a layer of stick shellac that matches the surface color.

NOTE: **Different colors can be made by heating and mixing stick shellacs. Acrylic artists paints may be used to replace stick shellacs.**

Step 3. Let this dry overnight.

Step 4. Brush the area surrounding the scratch or gouge with solvent until the finish softens and flows into the repaired area.

Step 5. After fully dry, rub with felt pad or 4/0 steel wool.

Step 6. Apply wax and rub.

PROBLEM: The entire surface of the wood is worn, faded, dull and needs refinishing.

INFORMATION: Sometimes an old finish has too many bad spots, or the area that needs repair are too large for small repair. In this case, the entire object must be refinished or stripped and have a new finish applied.

TOOLS AND MATERIALS:

Chemical stripper

Brushes

Steel wool, 4/0 and 2/0

Rubber gloves

Benzine

Putty knife

THE JOB: Refinishing old wood surfaces that are not damaged enough to require stripping the finish.

Step 1. Refinish a worn surface that is still adhering by cleaning it with Benzine.

Step 2. Rub the entire surface with 4/0 steel wool, gently along the grain of the wood.

Step 3. Refinish a faded or dull surface by cleaning with Benzine.

Step 4. Wipe on a thin glaze of diluted stain. Let it dry for 24 hours.

Step 5. Apply a top coat of finish that matches the old type of finish.

THE JOB: Stripping wood surfaces and applying new finish.

CAUTION: Stripping compounds are highly toxic. Be careful to avoid contact with skin and breathing the fumes. Use only in a well ventilated area. CAREFULLY READ and FOLLOW the directions specified by the manufacturer of the product.

Step 1. Remove all the drawers, doors, hardware, etc.

Step 2. Apply stripping compound in a thick coat with a brush, on a horizontal surface.

Step 3. Work only a small area at a time. Let it set for at least 15 minutes.

Step 4. Remove stripper by scraping with a putty knife. Be careful not to gouge the surface.

Step 5. Use 2/0 steel wool on stripped area to smooth surface and remove the rest of the stripper.

NOTE: Always use tools and wool in the direction of the wood grain. Wood may be softened by stripper so remove the stripper gently to avoid tool marks.

Step 6. After the entire piece is stripped, repeat the steps on areas where the old finish still remains until the piece is completely stripped.

Step 7. Fine sand the piece before applying the desired finish.

PROBLEM: Veneer is cracked, curling, blistered or scratched through the surface layer or solid wood. Surface is gouged too deep for surface repair.

INFORMATION: Repair of damaged or blistered veneer and solid wood surfaces should be done as soon as possible to prevent major surface problems.

TOOLS AND MATERIALS:

Tracing paper

Exacto knife

Wood glue

Iron

Clamp or weight

Piece of veneer patch or matching solid wood surface

Wax paper

THE JOB: **Repairing veneer.**

Step 1. Prepare damaged area by:

A. Covering surface with damp towel.

B. Applying heat to area with hot iron. This will soften veneer to prevent cracking.

Step 2. Tape tracing paper over damaged area leaving one side open.

Step 3. Trace the outline of the damaged area slightly larger than the area to be repaired.

Step 4. Slip veneer patch under the tracing paper, matching the grain pattern. Use the exacto knife and cut through both layers of veneer.

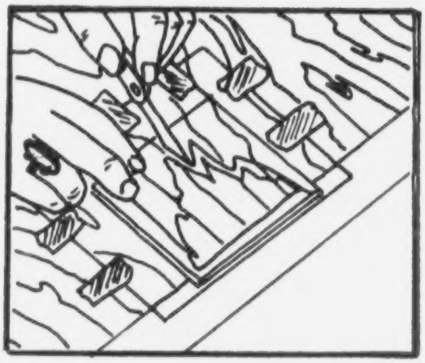

Figure 8.11. Use tracing paper to match a replacement patch of wood veneer.

Step 5. Remove both layers of veneer.

Step 6. Clean the area that was under the damaged veneer.

Step 7. Apply thin film of wood glue to dampened patch and place a patch in the area to be repaired.

Step 8. Cover the patch with wax paper. Put a block of wood over the wax paper and attach clamps or use a weight to press and hold the patch in place.

Step 9. Let dry over night.

Step 10. Apply new finish to repaired area, consult section on "Wood Care: Refinishing".

THE JOB: Repairing solid wood surface.

Step 1. Remove damaged area with a razor knife.

Step 2. Trace and cut out a cardboard template larger than the damaged area. Use a sharp knife.

Step 3. Use the cardboard template to cut a new piece, making sure the direction of the grain in the replacement piece matches the direction of the grain in the existing surface.

Step 4. Use the template to size the hole (or bed surface) for the patch to sit in.

NOTE: Use sandpaper on the edges of the patch and hole in order to make a perfect fit.

Step 5. Follow the directions given in Step 6 through Step 10 in "The Job: Care of Veneer" section above.

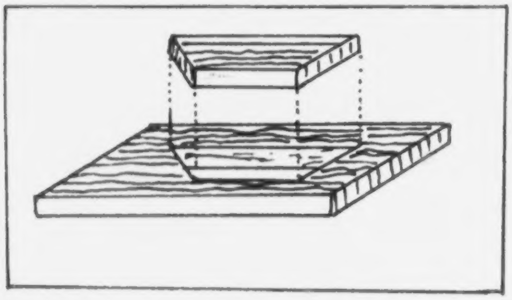

Figure 8.12. Make sure the new piece fits snugly into the hole and the grain is the same direction.

PROBLEM: Sticking drawers.

INFORMATION: Drawers may stick for a number of reasons. It may be a minor reason such as being too full, or it may need some repair work.

TOOLS AND MATERIALS:

Soap or bee's wax

Wood glue

Wood plane

Bar clamps

Canvas material

File

THE JOB: Doing a minor repair.

Step 1. Remove the drawers above and below the sticking drawer.

Step 2. Gently tug on the sticking drawer at both the top and bottom.

Step 3. If necessary, a thin straight edge may be slipped into the drawer to remove any blockage.

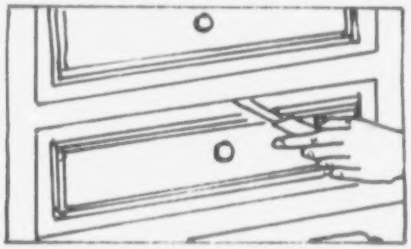

Figure 8.13. Gently use a flat edge to unstick the drawer.

Step 4. After drawer has been removed, check for damage or any reason it may be sticking.

NOTE: If physical condition of the drawer is very bad, a complete rebuild by a professional is probably needed.

Step 5. Inspect the drawer for worn or scraped surfaces. Use a plane or file on the worn or scraped areas to give the drawer a greater clearance.

Step 6. Rub all drawer runners and sliding surfaces with wax or a dry bar of soap to make them slide more easily.

THE JOB: **Repairing damaged drawers.**

Step 1. Take apart all drawer pieces and clean the surfaces.

Step 2. Split bottoms may be repaired with a glue soaked piece of canvas. Place the drawer bottom pieces together. Lay the canvas over the broken area and put a lot of glue on it. Work the glue in with the fingers. Let it dry over night.

Step 3. Put the drawer parts together and glue. Clamp into position with two bar clamps and let dry over night.

Step 4. Wax or soap all runners and sliding surfaces. If drawer does not fit, plane or file the surfaces before applying the wax or soap.

PROBLEM: Damaged or loose ceramic tile.

INFORMATION: The same methods and procedures for replacing damaged tiles is used for all ceramic accessories including, soap dishes, towel racks, and tooth brush holders.

TOOLS AND MATERIALS:

Matching replacement tile

Matching grout

Multi-purpose thin set mortar

Razor knife

Putty knife

Hammer

Chisel

Pliers

THE JOB: **Replacing a damaged ceramic tile.**

Step 1. Use a razor knife to score out the old grout that surrounds the area to be repaired. Be careful not to scratch the surface of the surrounding tiles.

Step 2. Remove the damaged tile:

A. Start at the center of the tile with a hammer and chisel and work out to the edge.

B. Take care to avoid damaging neighboring tiles.

C. When getting the tile out, use a putty knife and/or a chisel to clean the area under the tile until it is smooth.

Step 3. Install the replacement tile:

A. If necessary, shape the tile to fit.

1. Score tile to fit.
2. Cross hatch area to be removed with glass cutter.
3. Use pliers or nippers to break out small cross hatched pieces.
4. Check the tile for fit.

B. Apply multi-purpose thin set mortar to the back of the tile with a putty knife.

    1. Do not use an excessive amount of mortar.

    2. Do not put any mortar 1/2" from the edge of the tile.

C. Press tile firmly into place. Make sure tile surface is flush with surrounding tiles.

D. Remove any excess mortar with sponge and water.

E. If replacement is a heavy item such as a soap dish, tape into place or support it until the mortar is dry. Mortar takes about 2 hours to dry. Be careful not to get the area wet until it has dried completely.

Step 4. Mix matching grout according to product instructions.

Step 5. Force grout into grout joints.

Step 6. Wipe off excess grout with wet sponge.

A. Always wipe at a 45 degree angle to the grout joints.

B. Wipe until the grout is smooth and matches the existing grout joints.

C. Let it dry until a grout film appears on the tile surface. Then wipe the tile clean with a dry clean cloth.

THE JOB: Caulking grout joints that have developed cracks is a common problem where the tile meets other cermaic materials. Sometimes in the corners cracks also occur.

Step 1. Apply a thin bead of waterproof caulking along the cracked joint. Be sure the joint is clean and dry before applying the caulking.

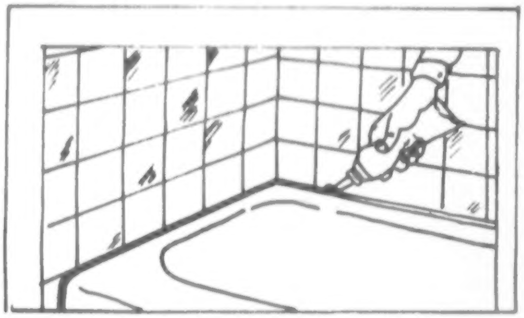

Figure 8.14. Use a thin bead of caulking around the bathtub.

Step 2. Smooth caulk bead with a wet finger or glove.

Step 3. Remove excess caulk from tile surface with a wet sponge.

PROBLEM: Broken or missing hearth bricks.

INFORMATION: Chopping wood and splitting kindling should be done outside. It keeps some of the wood stove mess out of the house. Chopping on the hearth can break the bricks. Broken or missing bricks can be replaced.

TOOLS AND MATERIAL:

Premix mortar

Matching brick

Putty knife or trowel

Bucket

Water

Wire brush

THE JOB: **Replacing The Hearth Bricks.**

Step 1. Scrape and chisel away all old mortar and brick pieces. Use a wire brush to finish the cleaning.

Step 2. Mix the mortar following the package instructions.

Step 3. Wet the new brick and the hearth area with clean water.

Step 5. Lay a bed of mortar on the hearth surface. Make it a little thicker, 1/4" or so thicker than the old mortar bed, because it will squish down and out.

Step 6. "Butter" the sides and end(s) of the new brick with an even coat of about 1/2" of mortar. Be sure to have plenty, because mortar cannot be squeezed in after the brick is laid.

Step 7. Shove the brick into place and tap gently with the handle of a tool to level and align it. Do not move a brick once laid and tapped in.

Step 8. Scrape off the excess mortar from the joints and the faces of the bricks.

Step 9. Use fingers or a tool handle to shape the joints like the others on the hearth.

Step 10. Wash tools and clean up.

DOORS AND WINDOWS . . . . Door Maintenance:

PROBLEM: Door does not open and close like it should, does not latch right, or will not lock or unlock.

INFORMATION: Wood responds to the weather conditions. In Arizona, the high humidity of the "monsoon" season causes wood doors and frames to absorb moisture and swell a bit in size. During the driest months, the wood dries out and shrinks. Also, the lumber used in a new home is higher in moisture content than the air so some shrinkage is expected throughout the house. All of these factors affect how a door fits in its frame.

Depending on soil type, moisture content and length of freezing and thawing periods, a house may "settle" into the earth over the years. Uneven settling can cause doors and windows not to fit or work right.

TOOLS AND MATERIALS:

Regular and phillips screwdrivers

Hammer

Sand paper/block

Wood plane

Cardboard or wood shims

Screws

Small metal file

Nail to drive hinge pin

Wood chisel

File

THE JOB: Adjusting Doors That Stick Or Will Not Close.

Probable cause is swelling that has made the door strike the frame and scrape. To fix this:

Step 1. Examine the door and frame carefully to see where it rubs. If rubbing is a small area and on the doorknob side of the door, use some 80 (heavy) grit sandpaper on a block of wood to make the door smaller in that area.

Step 2. If the rubbing is in a large area, on the top, bottom or hinge side, the door will have to be removed. Hinge types vary, but most have pins which can be removed without having to remove the hinge screws. Mark the areas on the door that bind with a light pencil before removing it.

If the hinge has a little hole in the bottom beneath the pin, use a large nail and hammer to start the pin out.

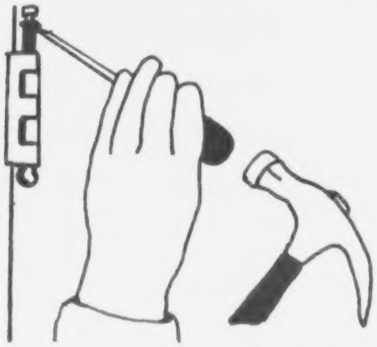

Figure 9.01. Gently use a screwdriver and hammer to tap the hinge pins out.

Remove pins carefully! Do not damage the wall or door surfaces. Have someone hold onto the door while you remove the hinge pins.

Step 3. To remove high spots on the door, use a wood plane. Remove only enough wood from high spots to let the door open and close easily.

THE JOB: Loosening Hinge Screws.

Step 1. This may also cause a door to not fit right. The screws should be tight. If the screws will not screw in tight, try screws the same size but a longer length, such as 1/4" to 3/8" longer. DO NOT predrill the holes.

Step 2. If that does not work, force plastic wood putty into the screw holes. Let it dry and then drill holes and install screws. There are also plastic inserts that can be inserted into the holes instead of wood putty.

THE JOB: Repairing The Door Latch Bolt That Does Not Enter The Strike Plate On The Door Frame.

Possible cause may be too wide a door frame gaps causing the latch bolt and strike plate to not match up.

Step 1. To move the door closer to the frame the hinges will have to be "shimmed". Longer screws will be needed.

Step 2. Remove the door as previously outlined in this section.

Step 3. Unscrew the hinges on the door frame.

Step 4. Use the hinge to cut out a shim of solid cardboard or thin wood to fit behind the hinge.

Step 5. Place shims into hinge notch and reinstall the hinge using screws about 1/4" to 3/8" longer.

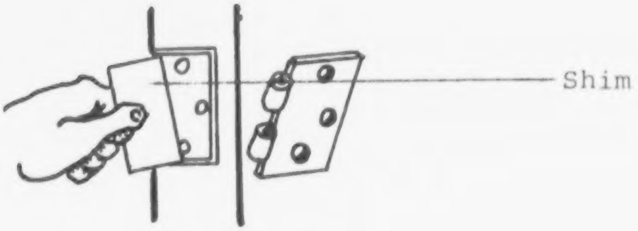

Figure 9.02. Use shims to adjust the door's angle.

Step 6. Vary the thickness of the shims to move the bottom or top of the door closer. It may take several trys to get it right.

Step 7. If the latch hits the strike plate in such a way that it will not enter the hole, two things can be done:

A. Use a metal file to enlarge the opening in the strike plate.

B. Move the strike plate by taking it off, chiseling a new location and remounting the plate.

THE JOB: Replacing A Doorknob Lockset.

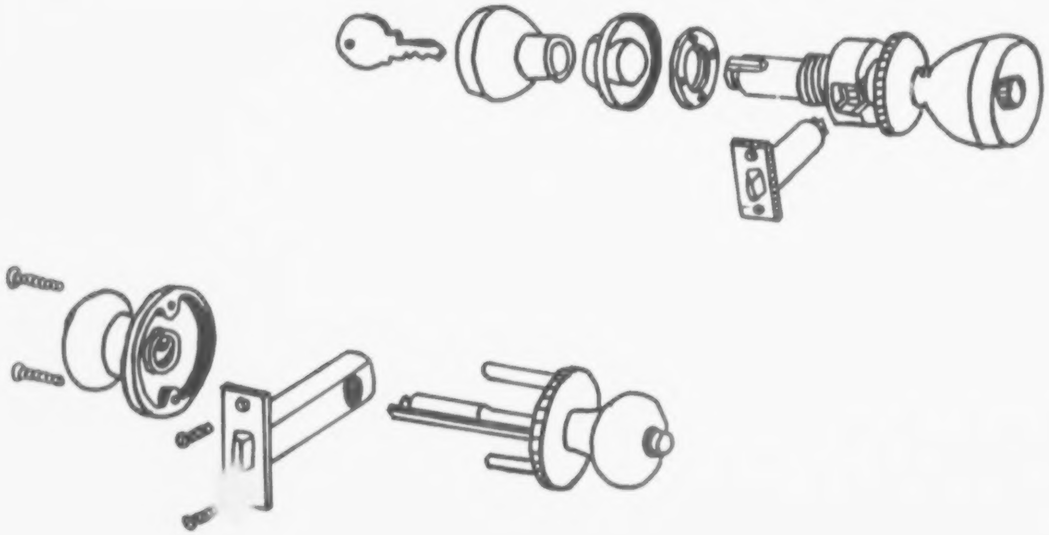

Figure 9.03. Two types of household locking door knobs.

NOTE: **The instructions with a lockset or deadbolt are good. Save them to use when putting in the new lock.**

Exterior locksets vary in style and parts but all will have a key as in the drawing on the preceding page. If the home you purchased was "pre-owned", change the keying immediately for security purposes. If the keys have been lost, replacement of the lockset may also be necessary.

If the lockset is high quality (expensive) remove it and take the lockset to a locksmith. He/she can install new tumblers, and make a new key.

Interior locksets (the bottom drawing shown on the preceding page) may also require replacement. Some types have a push/turn button lock, others may not. To change lockset type, replacement will be necessary.

NOTE: **All replacement locksets should come with installation instructions in the box. Before buying a new lockset, measure the thickness of the door. Measure from the edge of the door to the middle of the doorknob. It is also useful to remove the lockset and measure the size of the hole in the door. Make sure the new lockset will fit these measurements.**

REMOVING LOCKSETS

It may be necessary to carefully pry up a trim plate that covers the machine screws which hold the lock together. These screws will be on the inside of the door. A screwdriver will generally do the job.

DEADBOLTS

Deadbolts are superior to almost all locksets for providing secure locking to the home. If the exterior doors do not have deadbolts, consider replacing them. One inch (size of bolt) deadbolts are the best. If there is not a drill with the right size bit available, cut it with a coping saw. A sabre saw can also be used. Installing deadbolts should be left to a qualified carpenter or locksmith. For replacing a deadbolt follow the instructions on or in the box.

DOOR LUBRICATION: HINGES, LOCKSETS, DOORKNOBS

DO NOT use oil, on hinges, locksets, or door knobs, because it attracts dust that turns to grime that can make the parts stick. Also, the oil will stain paint and woodwork. Use very small quantities of either graphite or silicone base lubricants.

PROBLEM: Screen doors and windows are broken or damaged.

INFORMATION: Most window screens and screen doors are made of aluminum. While aluminum has good weather resistance, once broken or badly damaged it is hard to fix.

Screen material comes in either metal or plastic. Is is available at hardware stores and building supply yards. Rubber and plastic replacement splines, for holding the screen in, are also available.

Screen or storm doors that have been torn off by the wind can be repaired only if the hinges were attached by screws to both the door and the door frame. Use oversized screws to reattach and redrill hinges if necessary. If the hinges are "built-in", unscrew the entire door frame and take all parts to an aluminum door repair person.

TOOLS AND MATERIALS:

Replacement screen

Replacement spline

Waterproof glue

Brush for cleaning

THE JOB: Patching A Screen.

Step 1. If the hole or tear is small, close the hole with quick drying, waterproof glue. For plastic screens use an acetone based glue, or the glue might ruin the screen!

Step 2. To repair a larger hole, cut a piece of replacement screen larger that the hole. Bend and weave the strands into the screen. Use glue to secure the patch.

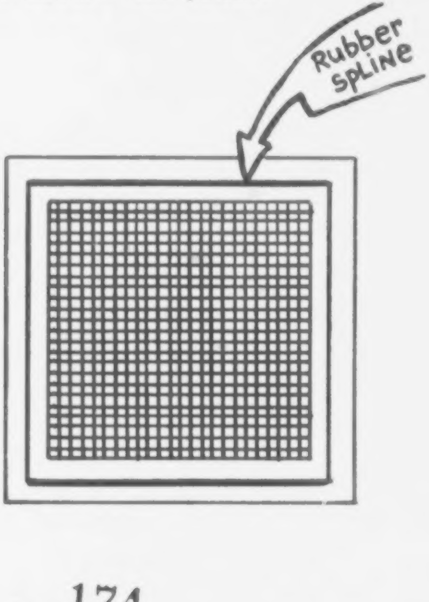

Figure 9.04. Repaired screen.

THE JOB: Replacing a screen.

Step 1. Cut the replacement screen to fit the outside size of the frame.

Step 2. Remove splines and all scraps of the damaged screen.

Step 3. Secure the screen into one side of the frame with the spline while someone else gently stretches it.

Step 4. While someone is stretching the screen slightly, secure it with the splines in both ends and then the other side.

NOTE: The original splines may not be re-usable. Plastic, rubber like replacement types are available. Take the damaged splines to the hardware store to get the right replacement.

PROBLEM: Broken window panes, or frames. Window does not slide well, or aluminum frame is oxidized.

INFORMATION: By far the most common window used in new homes today is the aluminum frame, double glazed, bypass slider. Though style and operation may vary, certain common problems occur.

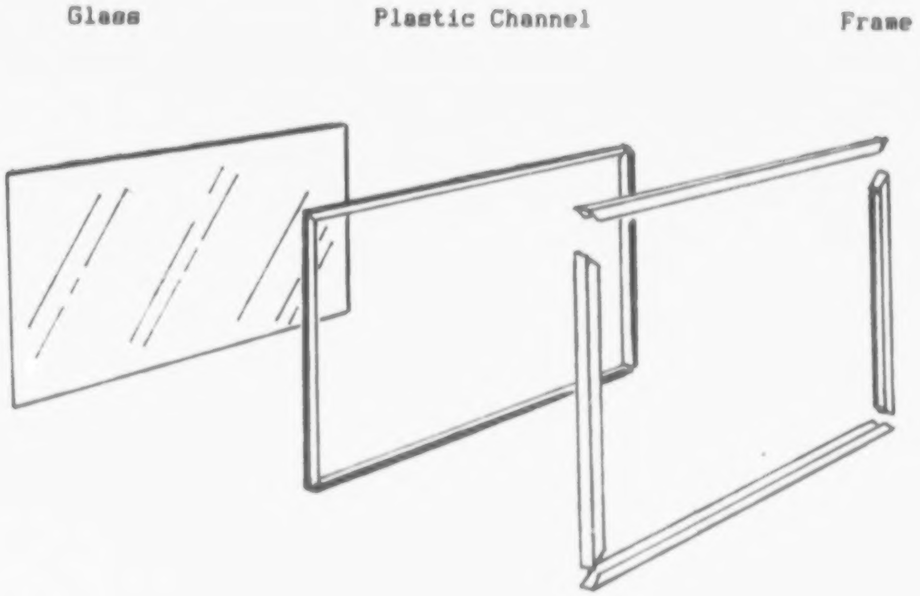

Figure 9.05. Window Pieces.

The aluminum frame is usually fastened together with screws at the corners. A plastic glazing channel is fitted around the window pane to provide a tight weather seal. The two panes of glass are separated by a "dead" air space for insulation. The entire frame and pane assembly is removeable for repair and maintenance. The method of removal depends on the manufacturer. Usually the sliding part lifts up and pulls out from the inside of the house. If the fixed window section does not come out the window may have to be repaired in place.

MAINTENANCE NEEDS

1. The sliding section of the window and the channel it slides in need to be cleaned and waxed, once in awhile, to assure smooth operation.
   - A. Remove the window section that slides.
   - B. Clean the window and frame channel throughly with a brush and mild detergent.
   - C. Dry off the parts and apply either stick parafin or wax paste.
2. Remove oxidation deposits (white chalky substance) by scrubbing with fine steel wool. A coat of automobile paste wax will protect it.

TOOLS AND MATERIALS:

- Gloves
- Pliers
- Glass cutter
- Replacement glass
- Kerosene or light machine oil

THE JOB: Replacing a glass window.

NOTE: To replace a broken window pane, have the glass supplier cut it. Be sure to take the correct measurements.

Step 1. Remove broken glass. Wear gloves! Remove all larger pieces. Save the little wire spring clips that hold the glass in the frame.

Step 2. Use pliers to remove the smaller pieces of glass. Then, wirebrush the glazing channels to get out any remaining slivers of glass.

Step 3. Remove the plastic glazing channel that weatherstrips the window pane. If damaged, replace it.

Step 4. Measure for replacement glass. Measure across the outside of the frame in several places to get the smallest distance. Then deduct 1/8" to allow room for expansion and contraction as temperatures change.

Step 5. Buy glass of the same type and thickness.

Step 6. It may be necessary to take apart one or more corners of the frame to get the glass in.

Step 7. If the glazing was installed with spring clips, replace the clips.

Step 8. If the weatherstripping (glazing channel) was separate pieces, replace it the same way it came out.

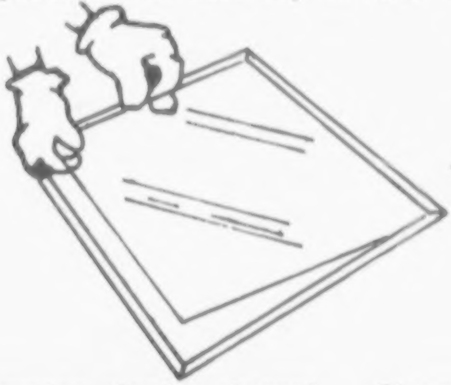

Figure 9.06. Securing glazing channel.

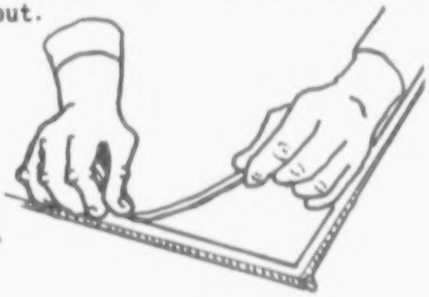

Figure 9.07. Use weatherstripping.

Glossary of Terms:

Acoustical Tile - A special tile for walls and ceilings made of wood, mineral, vegetable fibers, metal or cork. Its purpose is to reduce noise levels, while providing cover.

Aerator - Sievelike device on spigot end of faucet that mixes air with water flow.

Air Duct - Pipes that take warm and cold air to rooms and back to the furnace or air conditioning system.

Anode - The electrode in a cell (voltaic or electrolytic) that attracts the negative ions and repels the positive; the positive pole.

Backfill - Earth or gravel replaced in the space around a building wall or any excavation after pipe or foundations are in place.

Ball Cock - Assembly inside toilet tank that connects with water supply and controls flow of water into tank.

Baseboard - A board along the floor against walls and partitions in a building to hide gaps.

Basin Wrench - Tool designed to install or remove hard-to-reach locknuts holding deck-mounted faucet onto sink.

Batt - Insulation in the form of a blanket, rather than loose filling.

Batten - Small thin strips covering joints between wider boards on exterior building surfaces.

Battery - A device for converting chemical energy into electrical energy; two or more cells connected together as a unit.

Bevel - To cut edges or ends at an angle to make smooth mating joints between pieces.

Bib or Bobcock - A water faucet to which a hose may be attached. Also called a sill cock or a hose bib.

Bleed - To drain a pipe of excess air by opening a valve at end of pipe.

Bond - To glue together, as veneers are "bonded" to form a sheet of plywood. Pressure can be applied during the process to keep mating parts in proper alignment.

Brick Veneer - Brick used for the outer surface of a framed wall.

Built-up Roof - Roofing material applied in sealed, waterproof layers. Generally applied on nearly flat and/or roofs with a slight slope.

Butt Joint - A joint formed by meeting the squared ends or ends and faces of two pieces.

Cap - Fitting with a solid end used for closing off pipe end.

Carriage - That member which supports the steps or treads of a stair.

Casement - A window sash that opens on hinges placed along the side (vertical edge).

Casing - Window and door framing.

Caulking - Material used to create a watertight seal.

Chimney Cap - Concrete capping around the top of chimney bricks for purposes of protecting the masonry from the elements.

Circuit - The complete path of an electric current, including, usually, the generating device.

Circuit Breaker - A safety device used in electrical work which opens an electrical circuit automatically when it becomes overloaded.

Cistern - A tank used to catch and store rain water.

Cleanout - Opening providing access to drainline or trap under sink, closed with threaded plug.

Closet Auger - Tool for clearing blockages in toilet.

Compression Fitting - For copper and plastic pipe.

Condenser - A device consisting of two or more conductors separated by non-condutor material which holds or stores an electric charge.

Conductor - A material capable of transmitting electric current.

Control Panel - An upright panel, open or closed, where switches, rheostats, and meters are installed for controlling and protecting electrical devices.

Converter, rotary - An electrical machine having a commutator at one end and sliprings at the other end of the armature, used for the conversion of alternating to direct current.

Corner Bead - A wood or metal strip protecting the outside corners of plastered walls.

Corrosion - Pipes being eaten away gradually, by rust or chemicals.

Coupling - 1. Fitting used to connect two lengths of pipe in a straight run. 2. Term used to represent the means by which energy is transferred from one circuit to another.

CPVC - Plastic pipe for hot water. Chlorinated polyvinyl chloride.

Crawl Space - An unfinished space beneath the first floor of a building the ground, used for visual inspection and access to ducts and pipe.

Current - Alternating current (AC) reverses its direction of flow periodically. Direct current (DC) flows continuously in one direction. Gradual drift of free electrons, under pressure (voltage), along a conductor.

Double Glazing--Thermopane Windows - An insulating window pane formed of two thicknesses of glass with a sealed air space between them.

Double-Hung Windows - Windows with upper and lower sash, each supported by cords and weights.

Downspout - (Conductor pipe) A pipe used to carry rainwater down from a roof or from gutters.

Dry Rot - A term applied to many types of decay but especially to that which, when in an advanced stage, permits the wood to be easily crushed to a dry powder; the term is misleading because it is caused by moisture.

Dry Wall - A wall surface of material other than plaster, usually plasterboard.

Eaves - Roof extension beyond house walls.

Effluent - Treated sewage from a sewage treatment plant or from a septic tank.

Elbow - Fitting used for making turns in pipe runs (for example, 90-degree elbow makes right-angle turn). A street elbow has one male end and one female end.

Electrode - The solid conductors of a cell or battery which are placed in contact with the liquid; conductor that makes electrical contact with a liquid or gas.

Electrolyte - A substance that conducts a current by the movement of ions. The liquid in a battery or other electrochemical device.

Energy - The ability or capacity for doing work.

Epoxy - A synthetic resin used in some paints and adhesives because of its toughness, adhesion, and resistance to solvents.

Erosion - Soil being gradually worn away by wind and water.

Escutcheon - Decorative piece that fits over faucet body or pipe coming out of wall.

Female - Pipes, valves, or fittings with internal threads.

Fill-Type Insulation - Loose insulating material applied by hand or mechanically blown into wall spaces.

Filter - A device which is used to clean particles from air or water.

Flange - Flat fitting or integral edging with holes to permit bolting together (toilet bowl is bolted to floor flange) or fastening to another surface (tub is fastened to wall through an integral flange).

Flapper - Device that replaces a tank stopper in a toilet.

Flare Fitting - Threaded fitting used on copper and plastic pipe. Requires flaring one end of pipe.

Flashing - Metal used around angles or junctions on exterior walls, chimneys, or roofs to prevent leaks.

Flexible Connector - Bendable piece of pipe that delivers water from a shutoff valve to a fixture or appliance.

Float Arm - Wire arm that connects float ball to ball cock assembly in the toilet tank.

Float Ball - Large copper or plastic ball that floats on surface of water in toilet tank, rises and lowers with water level.

Floor Flange - Fitting that connects toilet to floor and drainpipe.

Floor Joists - Framing pieces resting on outer foundation walls and interior beams or girders.

Flue - A chimney passageway for conveying gases, smoke, and fumes to the outside air.

Flush valve - Controls flow of water in a toilet from tank into bowl.

Flux - Paste applied to copper pipe before soldering. Prevents oxidation when heat is applied to metal.

Footing - The concrete base on which a foundation sits.

Foundation - Lower wall parts on which a structure is build. Masonry and concrete foundation walls usually extend at least 8" above exterior grade.

Frame Construction - A type of building in which the structural parts are wood or dependent on a wood framework for support. Commonly, lumber framing is sheathed with plywood or boards for floors, walls, and roof.

Fuse - A safety device in an electrical panel box which breaks (opens) an electrical circuit when it becomes overloaded.

Gable - The triangular part of a wall under the inverted V of the roof line.

Gasket - Device (usually rubber) used to make the joint between two valve parts watertight.

Generator - A machine that converts mechanical energy into electrical energy.

Glazing - Fitting glass into windows or doors.

Grain - The direction, size, arrangement, appearance, or quality of the fibers in wood. To have a specific meaning the term must be qualified:

1. **Along-The-Grain** - In the same direction as the grain; in plywood, the same direction as the grain of the face ply, usually the long dimension. Plywood is stronger and stiffer along the grain than it is across the grain.

2. **Cross-Grained** - Wood in which the fibers deviate from a line parallel to the sides of the piece in a diagonal or spiral grain or a combination of the two.

Graphite Packing - Wirelike material to be wrapped around faucet stem to prevent leaking.

Ground - A connection made directly to the earth or to a frame or structure which serves as one line of a circuit.

Insulating Board or Fiberboard - A low-density board made of wood, sugar cane, cornstalks, or similar materials, usually formed by a felting process, dried and pressed to a specified thickness.

Insulation - Any material high in resistance to heat transmission that, when placed in the walls, ceilings, or floors of a structure, will reduce the rate of heat flow.

Interrupter - A device for the automatic making and breaking of an electrical circuit.

Invertor - Units which change 12 volt DC to 115 volt AC power.

Jamb - The side post or lining of a doorway, window or other opening.

Joint - Point at which two sections of wood, veneer, or pipe are fitted together.

Joist - Horizontal framing member that supports a floor or the laths or panels of a ceiling.

Knot - The portion of a branch or limb that has been surrounded by subsequent growth of the wood of the tree trunk.

Landscaping - Improving the natural beauties of a tract of land by grading, clearing, or decorating with plants.

Lath - A building material of wood, metal, gypsum, or insulating board on which plaster is spread.

Locknut - A nut screwed tight onto another nut to lock it in position.

Main Cleanout - Y-shaped fitting near bottom of soil stack or where drain leaves house.

Male - Pipes, valves, or fittings with external threads.

Masonry - Stone, brick, concrete, hollow-tile, concrete block, gypsum-block, or other similar building units or materials or a combination of the same, bonded together with mortar to form a wall, pier, buttress, or similar mass.

Miter - The joining of two pieces at an angle that bisects the angle of junction.

Molding - A strip or piece of decorative material having a plane or curved narrow surface prepared for ornamental application. These strips are generally used to hide gaps at wall junctures.

Moisture Barrier - Treated paper or metal that retards or bars water vapor, used to keep moisture from passing into floors or walls.

Motor - A device for converting electrical energy into mechanical energy.

O-Ring - Narrow rubber ring used in some faucets instead of packing to prevent leaking around stem; also, used with swivel-spout faucets to prevent leaking at base of spout.

Packing nut - Nut screwed down onto faucet stem, holding packing tight.

Pipe Cutter - Various tools designed for making perfectly square cuts on pipe.

Pipe Joint Compound - Sealing compound used on threaded fittings (apply to external threads).

Pipe-Wrap Tape - Special tape used as a joint sealer in place of pipe joint compound. Also, called fluorocarbon tape.

Pitch - The angle of slope of a roof. Also, an accumulation of resin.

Plug - Closed-end, externally-threaded fitting for closing off pipe end that has internal threads.

Plywood - A panel made of three or more layers of veneer joined with glue and usually laid with the grain of adjoining plies at right angles. To secure balanced construction, an odd number of plies is almost always used.

Power Snake - Electrically powered snake used for clearing blockages in main drain and house sewer. Available at rental stores.

Preservative - Any substance that, for a reasonable length of time, will prevent the action of wood-destroying fungi and borers, and other destructive insects when the wood has been properly coated or impregnated with it.

P-Trap - Fixture trap in the shape of a letter P.

PVC - Rigid plastic pipe for cold water. Polyvinyl chloride.

Rafter - A series of roof framing members. Members supporting roofs having slopes 3 in 12 or less are defined as roof joists.

Rectifier - Device for changing alternating current to pulsating direct current.

Regulator - Maintains a constant flow of electrical power.

Relay - Device for controlling electrical circuits from a remote position; a magnetic switch.

Resistance - The opposition of a conductor to an electric current.

Rheostat - A variable resistance for limiting the current in a circuit.

Roof Covering - Any type of material put on a roof to make it watertight.

Roof Sheathing - Boards or plywood nailed to the top edges of rafters to tie the roof together and support the roofing material.

Seat - Valve part into which washer or other piece fits, stopping flow of water.

Series Connection - An arrangement of cells, generators, condensers, or conductors so that each carries the entire current of a circuit.

Shake - A hand or machine split wooden shingle, usually edge grained.

Sheathing - The structural covering, usually boards or plywood, placed over an exterior framing. Exterior facing material is attached to it.

Shim - Thin tapered pieces of wood used for leveling or tightening a stair or other building element.

Siding - The finish covering of the outside wall of a frame building.

Sludge - Solid waste matter that settles to the bottom of a septic tank.

Snake - Springlike tool forced into waste lines to break up blockages.

Solder - Soft metal wire (tin and lead) used as a bonding agent to join copper pipe.

Span - The distance between supports.

Split - A lengthwise separation of the wood, due to the tearing apart of the wood cells.

Standpipe - Special drainpipe for clothes washer.

Starter - A device used in conjunction with a ballast for the purpose of starting an electric discharge (flourescent) lamp.

Stopper - Device that fits over flush valve opening at bottom of toilet tank. When raised, permits water in tank to flow downward into bowl.

Stud - Generally, 2 X 4s used as the basic vertical framing members of walls. Studs are usually spaced either 16" or 24" apart.

Sweating - 1. Another name for soldering joints. 2. Accumulation of moisture on pipes, tanks, walls, caused by condensation when collar surfaces of pipe, tank or wall meets warm air.

Tank Ball or Flapper- Device that replaces a tank stopper in a toilet.

Tempering Valve - Valve that mixes a small amount of hot water with cold water entering toilet tank in order to prevent a sweating tank.

Thermocouple - A device for directly converting heat energy into electrical energy.

Toggel Bolt - Bolt with two hinged wings, used to fasten brackets to wall materials; can also be used to repair leaks in water tanks.

Tongue-and-Groove - A carpentry joint in which the jutting edge of one board fits into the grooved edge of a mating board.

Torch - Tool that uses acetylene, butane, or propane to solder pipes together.

Transformer - Device for raising or lowering AC voltage.

Trap - A bend in a water pipe to hold water so sewer and/or other gases from the plumbing system do not escape into the building.

Truss - A combination of structural members so arranged and fastened together that external loads applied at the joints will result in only direct stress in the members.

Valve - Device that controls the flow of water, or gas.

Valve Seat Dresser - Tool used to grind down burrs on valve seat.

Valve Seat Wrench - Hexagonal-end wrench inserted into hexagonal opening in valve seat for installing or removing seat.

Veneer - 1. A Thin layer or sheet of wood. 2. An outer facing of brick, stone or other material placed on a wall for protection or decoration and not for strength.

Vent Pipe - A pipe which allows gas to escape from plumbing systems.

Voltage Regulator - Device used in connection with generators to keep voltage constant as load or speed is changed.

Voltmeter - An instrument for measuring potential difference or electrical pressure.

Wall switch - A switch on the wall, not a part of any fixture, for the control of one or more outlets.

Warp - Any variation from a true or plane surface. The term covers a crook, bow, cup, twist, and any combination of these.

Warranty - An agreement given by the seller of an item, that insures that proper use and wear will not cause damage or harm to the appliance.

Weatherstripping - Metal, wood, plastic or other meterial so designed that when installed at doors or windows will retard the passage of air, water, moisture, or dust around the door and window openings.